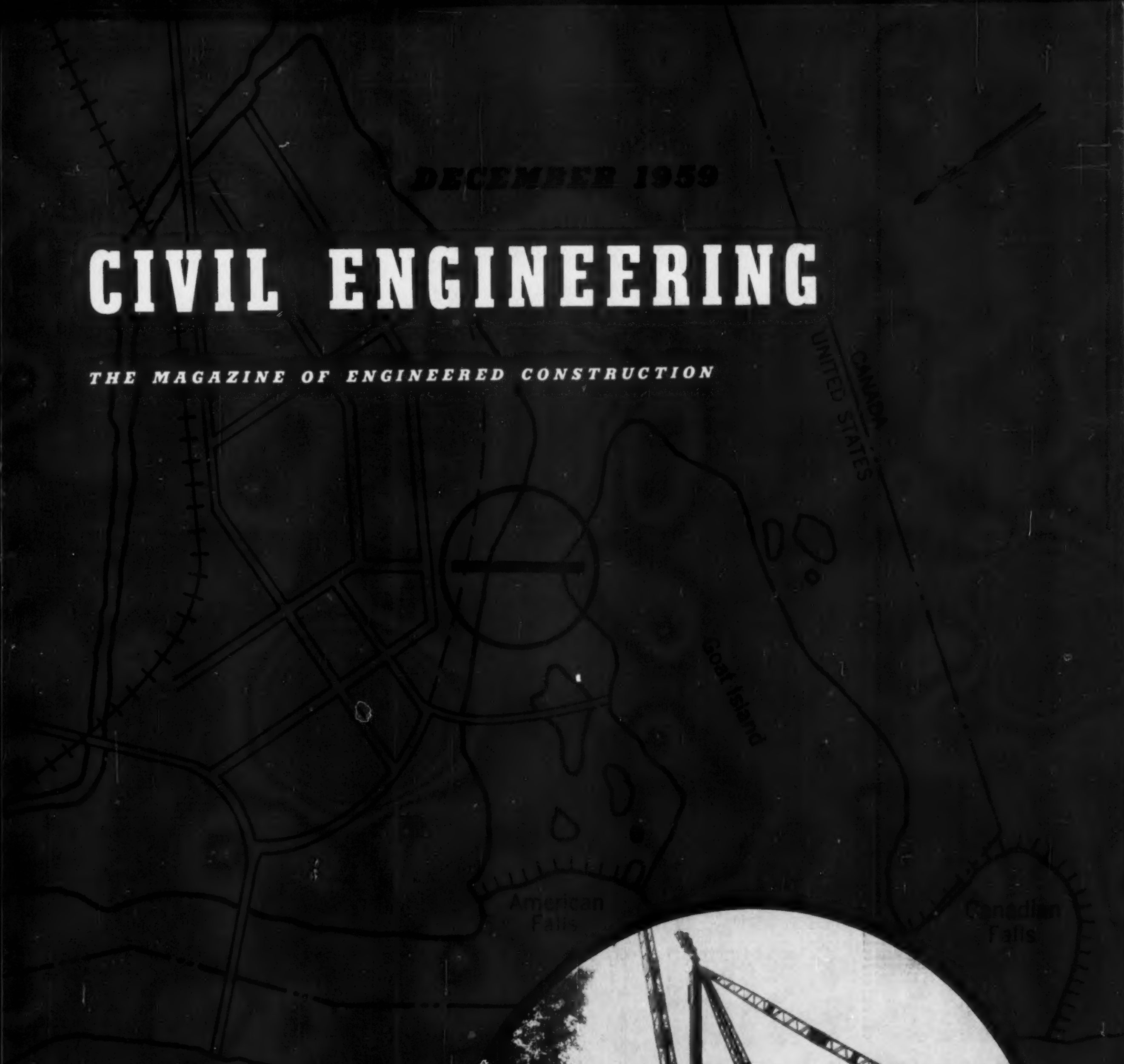
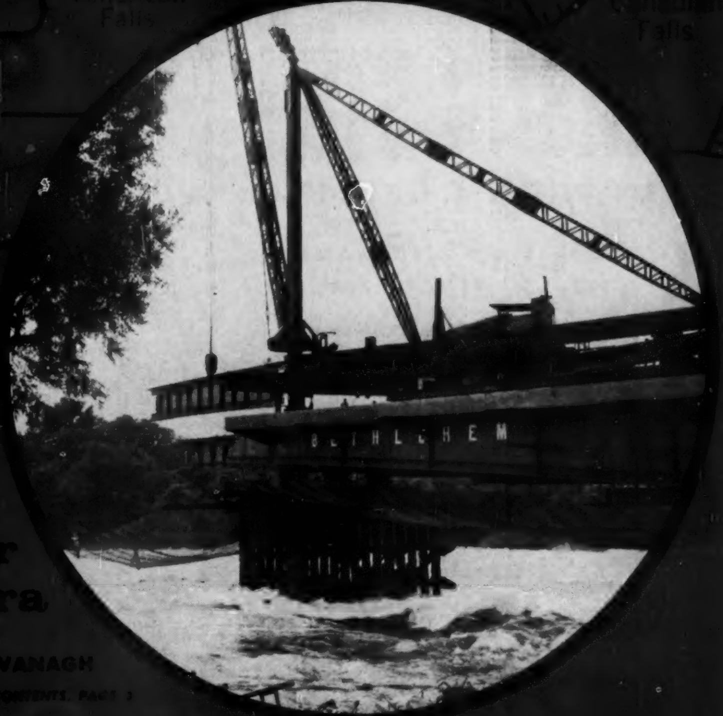
DECEMBER 1959

CIVIL ENGINEERING

THE MAGAZINE OF ENGINEERED CONSTRUCTION





AMERICAN SOCIETY OF CIVIL ENGINEERS FOUNDED 1852

450-ft plate-girder span at Niagara

See article by FRASER and KAVANAGH

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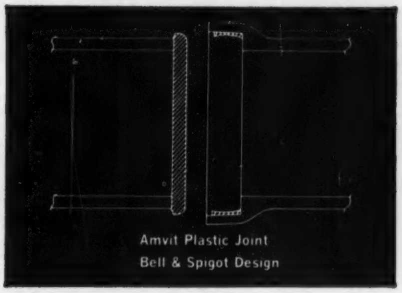
longer, stronger AMVIT Clay Pipe protects community health SIX WAYS

Clay Pipe is the Only Material Guaranteed to Serve Your Community Long After the Sewer Bonds are Paid Off

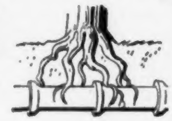


Each year thousands of taxpayers' dollars are wasted on "substitute" materials used in sewer lines. Failure and collapse of non-clay sewers endangers the health of the community. Sewers must be constructed of permanent materials for they carry to safe disposal thousands of tons of waste laden with dangerous and deadly bacteria.

Amvit* Jointed Clay Pipe gives decades of uninterrupted underground service. Neither joint nor pipe is affected by these factors:

1. ROOTS

force the pipe out of line and clog the system in search of moisture. Amvit is a compression joint on the ball and socket principle. The surfaces of both bell and spigot are in constant compression. Roots cannot enter the line.



2. CHEMICAL ATTACK

is from acid-laden, high temperature sewage, discharged from dishwashers, garbage disposal units and washing machines. Like the clay pipe, Amvit Joint is acid resistant and will not corrode or decompose like most substitute pipes.

3. FLOW LINE ATTACK

refers to that section of the pipe which lies between low and high water. Grease and scum tend to build up here and act as a solvent on certain synthetic substitute pipes. The design of the Amvit Joint assures that the pipe is self-centered at all times. This gives perfect alignment and self-cleansing.

4. EROSION

is the wearing out of pipe by abrasive action of sand and gravel. Soft pipes, such as those made of paper and coal tar, become scratched and roughened and tend to clog up. Because Amvit is a really tight joint, no foreign matter can possibly enter the line.

5. DECOMPOSITION

is the chemical breakdown of the component elements of the pipe. Only clay pipe resists decomposition. Like the pipe, the joint is unaffected by ordinary conditions of underground service.

6. RODENTS AND TERMITES

will gnaw away wrappings and coatings of composition pipe. Amvit Clay Pipe defies even the sharpest toothed rodent and is immune to termite attack.

For more information on how Amvit can help cut sewer project costs, write or call American Vitrified Products Company, National City Bank Building, Cleveland, Ohio, or our office nearest you for a new descriptive folder.

*T. M. Registered

SALES OFFICES:

Cleveland	TO 1-6750
Chicago	ST 2-5243
Detroit	GA 1-1940
Los Angeles	EL 9-4535
Milwaukee	HO 6-4990
St. Louis	HA 9-5400

SINCE 1848

AMERICAN

American Vitrified Products Company

CLEVELAND OHIO

Plants Across the Nation... Brazil, Indiana • Chicago, Illinois • Cleveland, Ohio • Crawfordsville, Indiana • Detroit, Michigan • East Liverpool, Ohio • Grand Ledge, Michigan Lisbon, Ohio • Los Angeles, California • Milwaukee, Wisconsin • South Bend, Indiana • St. Louis, Missouri • Whitehall, Illinois • Somerville, New Jersey (Completion early 1960).

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CIVIL ENGINEERING

DECEMBER 1959
VOL. 29 • NO. 12

THE MAGAZINE OF ENGINEERED CONSTRUCTION

• ARTICLES

• SOCIETY NEWS

• NEWS BRIEFS

• DEPARTMENTS

Illinois modernizes U.S.-36 with Asphalt

Contractor

McMahon-Illinois Corp. and Parro Construction Co., Urbana, Ill.

Constructing a heavy-duty pavement of Plant-mixed Texaco Asphaltic Concrete on 17 miles of U. S. Route 36 near Tuscola, Ill. New pavement, shown at right, was laid in four courses.

When Illinois modernized the worn, narrow concrete pavement on 17 miles of U. S. Route 36, the project had one unusual feature — the thickness of the new Plant-Mixed Texaco Asphaltic Concrete pavement.

Last year, after the old pavement had been undersealed with asphalt, it was covered by two courses of Texaco Asphaltic Concrete, a 1-inch leveling course and a 2-inch surface.

In 1959, when the pavement was widened, two more layers of Texaco Asphaltic Concrete were added, each 1½-inches thick. As a result, this section of U.S.-36 now has a heavy-duty 6-inch asphalt pavement capable of withstanding the weight and impact of modern truck traffic year after year with a minimum of upkeep.

Whether you are interested in a heavy-duty asphalt pavement such as Plant-Mixed Asphaltic Concrete, or one of the low-cost types of asphalt surfacing, helpful information on all of them is available in two free Texaco brochures. Copies can be secured without obligation by writing our nearest office.

TEXACO INC., Asphalt Sales Div., 135 E. 42nd Street, New York City 17

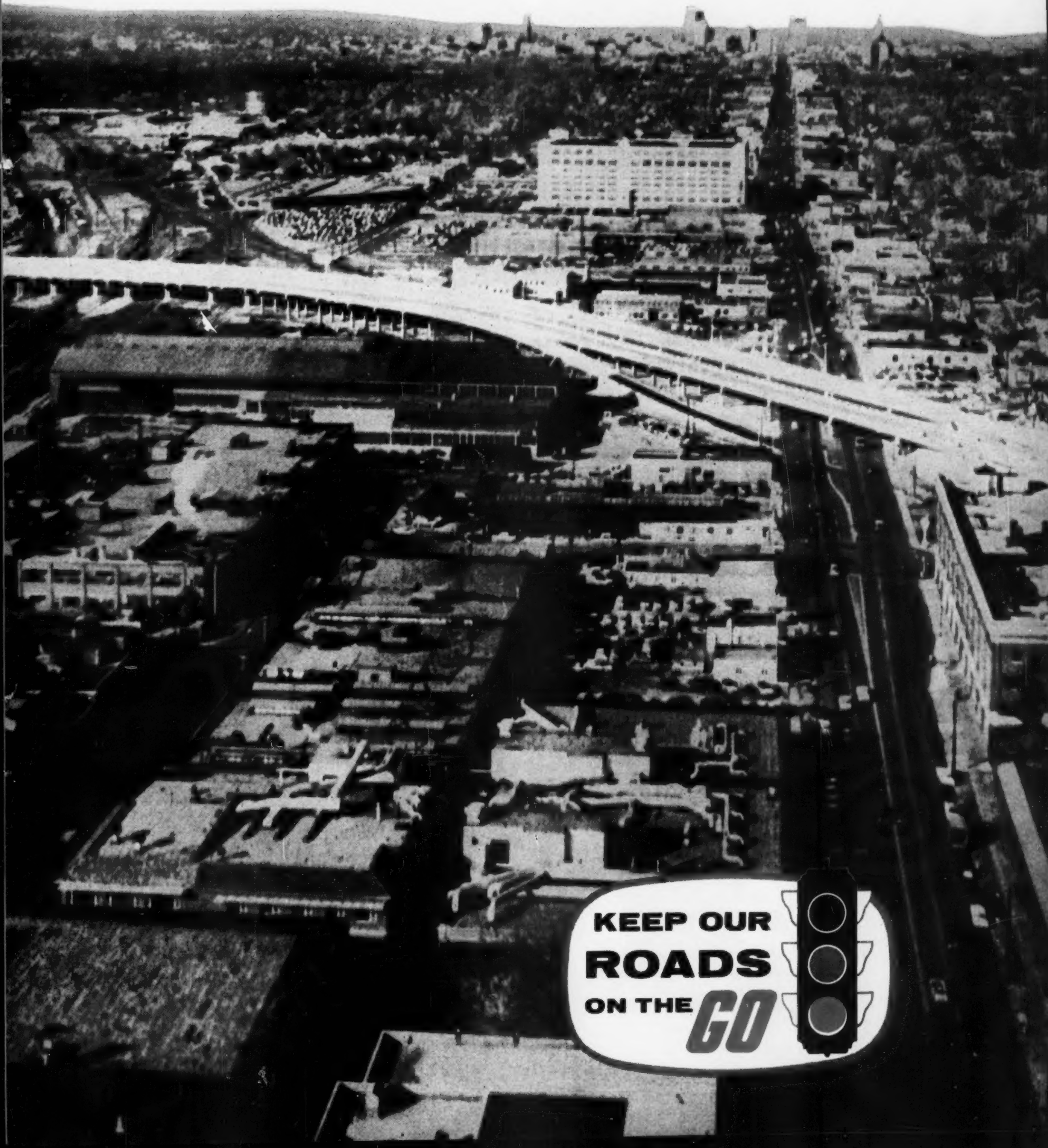
Boston 16 • Chicago 4 • Denver 1 • Houston 1 • Jacksonville 1 • Minneapolis 3 • Philadelphia 2 • Richmond 25

TEXACO ASPHALT

Colorado rolls out 964 miles of Interstate Roads

Looking north on Broadway toward downtown Denver on skyline. Elevated section of new Valley Highway crosses center of picture.

Additional pictures on following pages ..

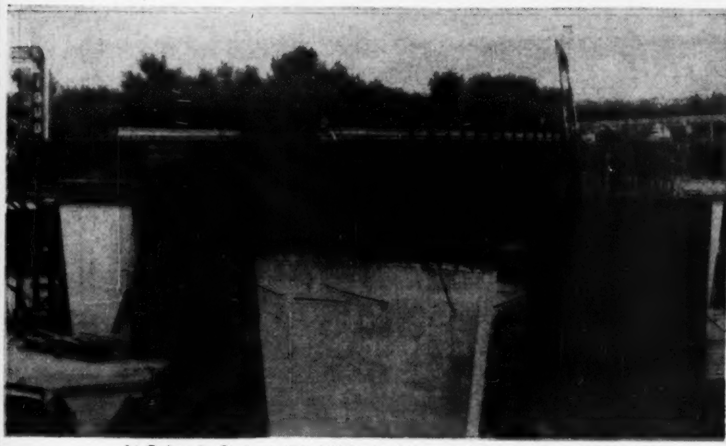


Section of structural steel elevated highway in Denver, connecting north-south Interstate Road with road planned from Denver into Utah. This road to the west crosses the rugged Rockies, requiring an exceptional number of bridges.

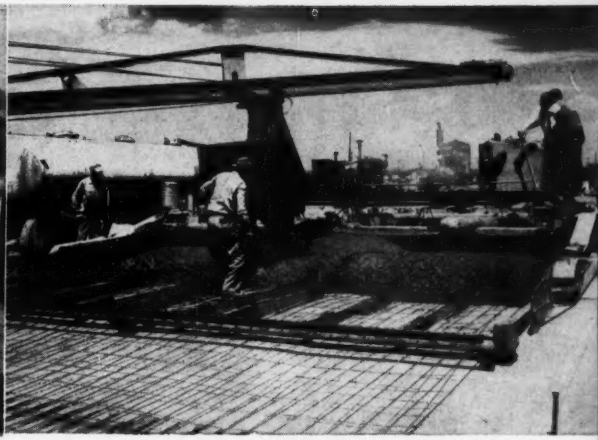
In busy Denver area, steel bridge construction provides maximum clearance on short span. Tubular light poles, bridge rails, and sign supports of hot-dipped galvanized steel provide long, maintenance-free service.

Colorado is building 964 miles of Interstate Roads

Workmen assemble steel girders on new 150-foot bridge near Pueblo where railroad crosses U.S. 85-87.



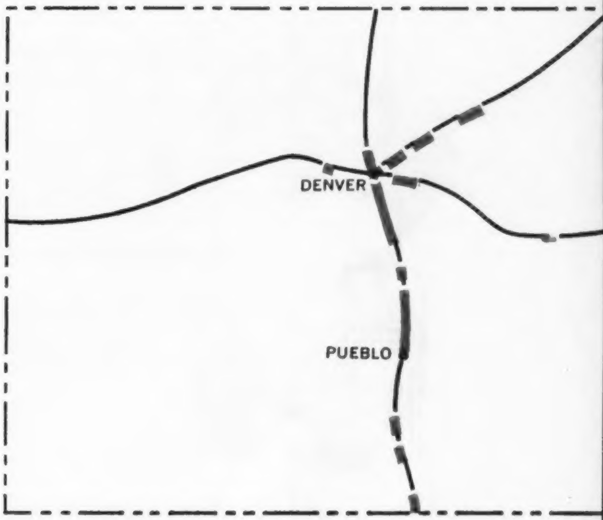
At Colorado Springs, this 393-foot bridge provides quick routing for four lanes of traffic through town on U.S. 85 and 87. Steel reinforcing bars in these tapered piers assure the extra strength needed in this construction.



Colorado's highway engineers devised this efficient non-stop slip-form paver. In one continuous operation, it raises pre-joined strip of welded steel wire fabric to desired height, pours concrete through fabric and over it, levels the surface, forms a perfect edge with the moving edge-guide, and leaves behind an almost completed concrete highway.

with help of USS Highway Products

An impressive sight in Colorado these days is the explosive growth of first-rate roads. The Interstate Highway Program is in full swing. $324,300,000 in federal and state funds is being spent to construct 964 miles of new Interstate Highways and 5,200 new bridges. Already, more than 163 miles have been completed at a cost of about $20,700,000. The 8,433 miles of older roads in Colorado will receive a $2 billion modernization. Plans for the entire program are based on an expected 1975 traffic volume of 6½ million vehicles—over 3 times greater than present loads. This work is under the direction of Joseph J. Marsh, Chairman, Colorado Highway Commission, and Mark U. Watrous, Chief Highway Engineer.



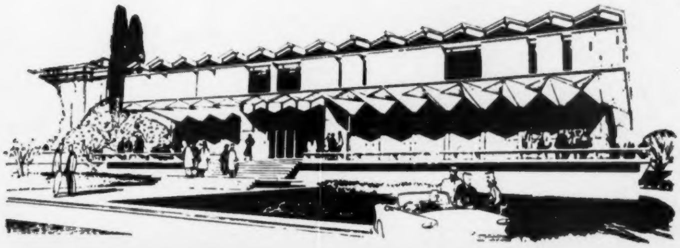
United States Steel makes a complete line of highway products: Structural carbon steel, high-strength and constructional alloy steels for bridges; steel H-piles, sheet piling and tubular piles for bridge foundations; drainage products; cements for all types of concrete construction; slag, reinforcing bars and welded wire fabric; wire rope, cable, tubing and special steels for construction equipment; fence; beam and cable guard-rail, steel for signs . . . and dozens more.

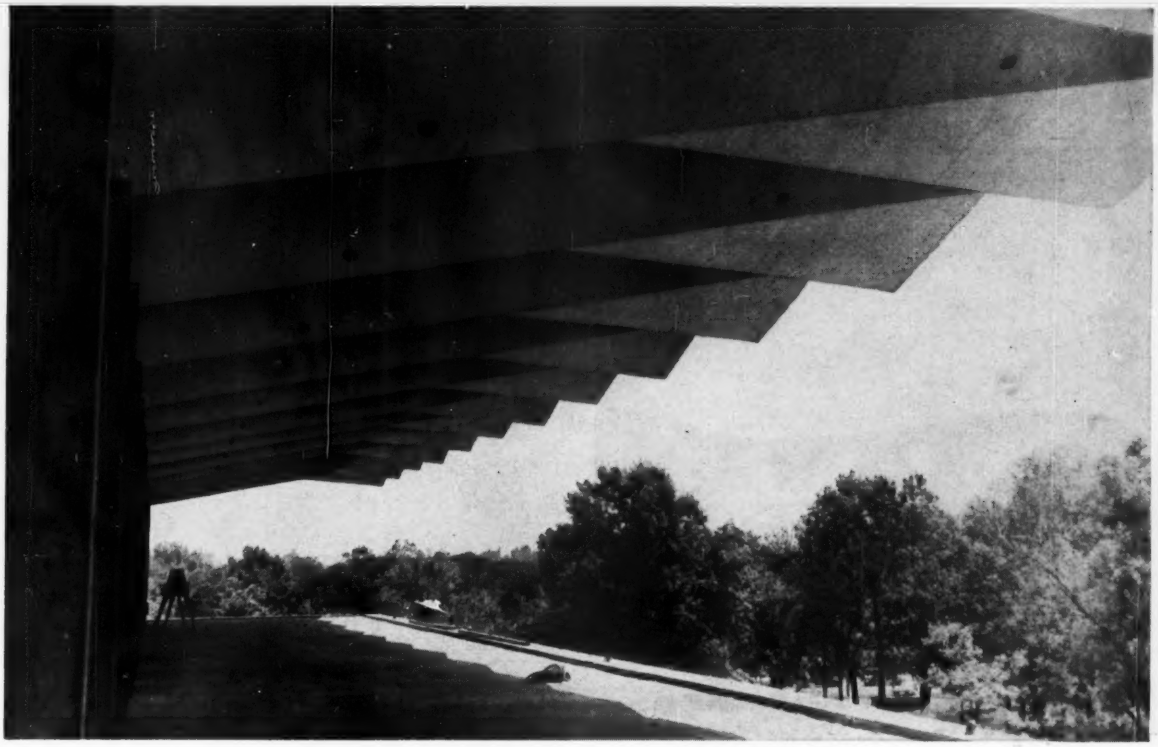
USS is a registered trademark

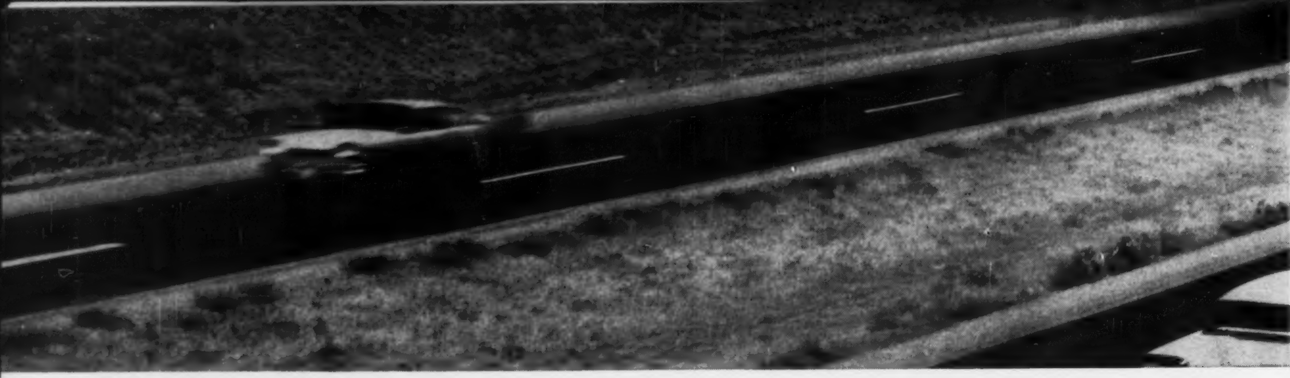
USS United States Steel

Write for the *free* 54-page booklet, "Keep Our Roads On the Go." You'll find all the United States Steel products and services that will help you cut costs and speed operations in highway construction. United States Steel, 525 William Penn Place, Pittsburgh 30, Pennsylvania.

The highway market is served by the following divisions of United States Steel; American Bridge Division, Pittsburgh, Pa.; American Steel & Wire Division and Cyclone Fence Dept., Cleveland, Ohio; Columbia-Geneva Steel Division, San Francisco, Calif.; Consolidated Western Steel Division, Los Angeles, Calif.; National Tube Division, Pittsburgh, Pa.; Tennessee Coal & Iron Division, Fairfield, Ala.; Universal Atlas Cement Division, New York; United States Steel Supply Division, Steel Service Centers, Chicago, Illinois.







Oklahoma makes <u>sure</u> Interstate 40

First, primes subbase... then hot mixes...

Here's a pavement with future!

For years to come, it's sure to carry the heaviest traffic without distress. Built to do so. With an Asphalt base to reduce stresses imposed on the subgrade.

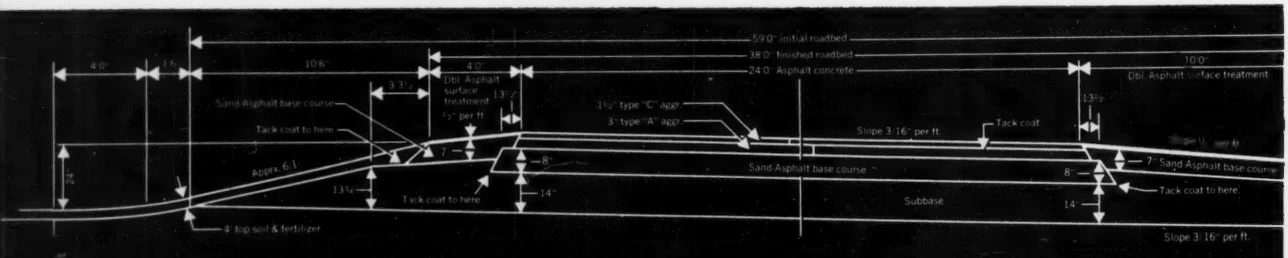
This type construction is recommended to prevent accumulation of capillary moisture and water vapor in the pavement courses where high strength is required.

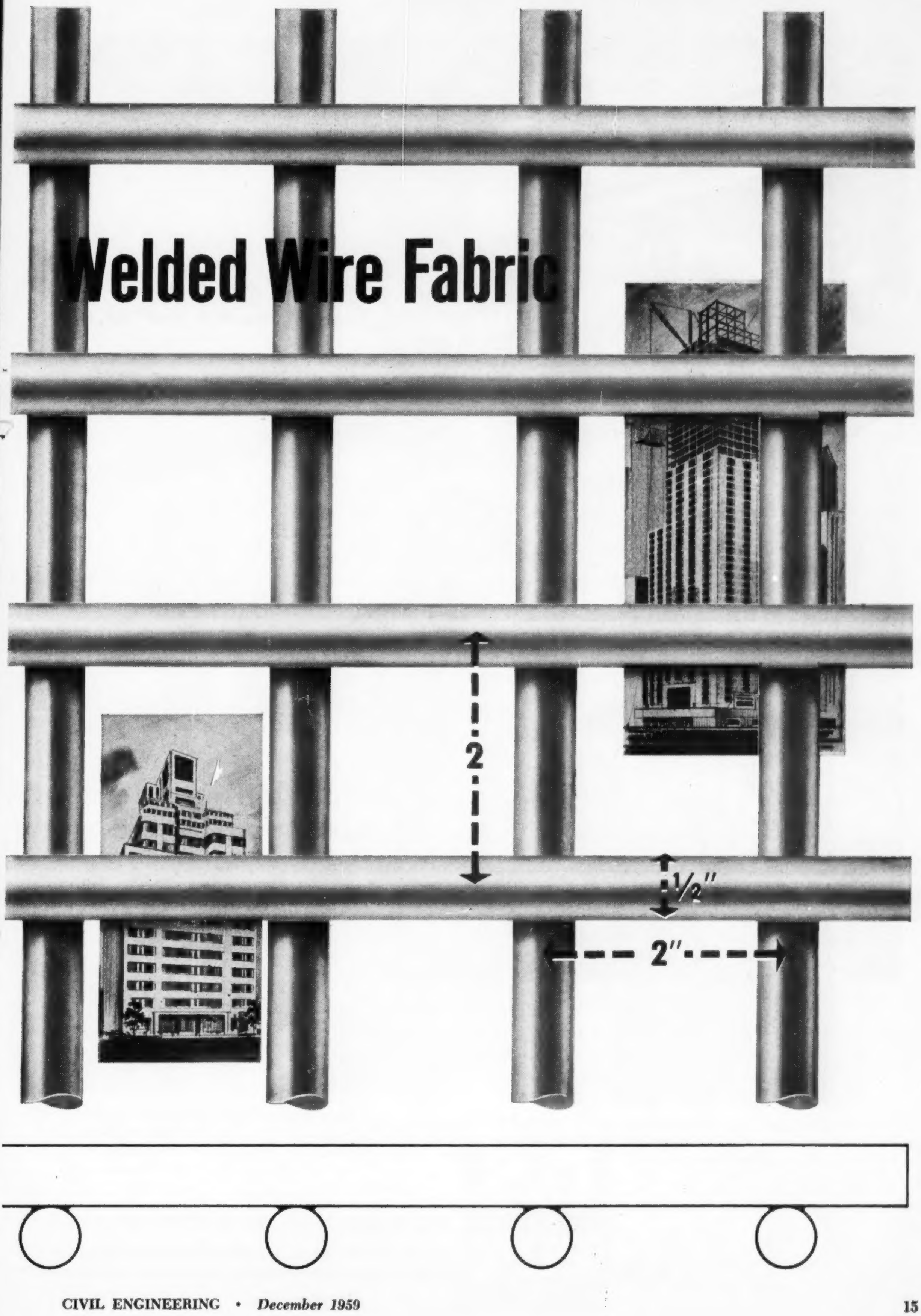
Builds up strength layer by layer

After proper compaction of the A-7-6 subgrade, fourteen inches of subbase (10-16 CBR) were placed full width of the roadbed. This subbase was primed with 0.2-0.4 gals./sq. yd. of MC-1 to insure bond with the succeeding high-strength Asphalt base course.

Then four 2-inch courses of hot-mixed sand-Asphalt base (Hveem stability, 26-27) were laid.

After tacking the base with diluted Asphalt emulsion,




Welded Wire Fabric
2
½″
2″

BASIC...

FOUNTAIN OF YOUTH, 1880...The well of the Little Red Schoolhouse was a popular, if not always healthful, gathering place for children. The old tin dipper in its lip-to-lip travels carried more than its share of disease.

THE MODERN DRINKING FOUNTAIN...eliminates the community cup...substitutes for it clean, pure, safe water distributed nationwide over a network of dependable cast iron pipe.

U.S. cast iron PIPE

FOR WATER, SEWERAGE AND

U. S. PIPE AND FOUNDRY COMPANY

but better than ever today!

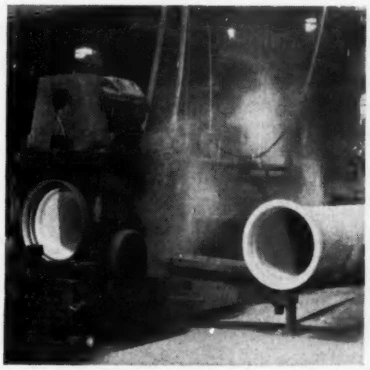
Care and precision from mine to main insure U. S. Pipe quality

The nation's health depends largely on water. And most of this water is distributed through cast iron pipe.

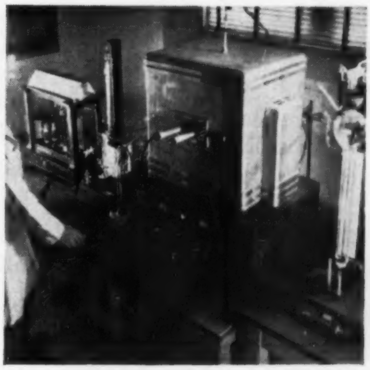
U. S. Pipe, therefore, exerts every effort to make its product dependable, long-lived and trouble free. From mining of ore... through blast furnace... to final shipping, every length of U. S. Cast Iron Pipe is checked and rechecked for quality.

This end-to-end supervision is another reason U. S. Pipe measures up to the promises made for it... and to the responsibilities placed on it in service.

QUALITY BEGINS HERE . . . at one of U. S. Pipe's mines near Birmingham where ore is mined.



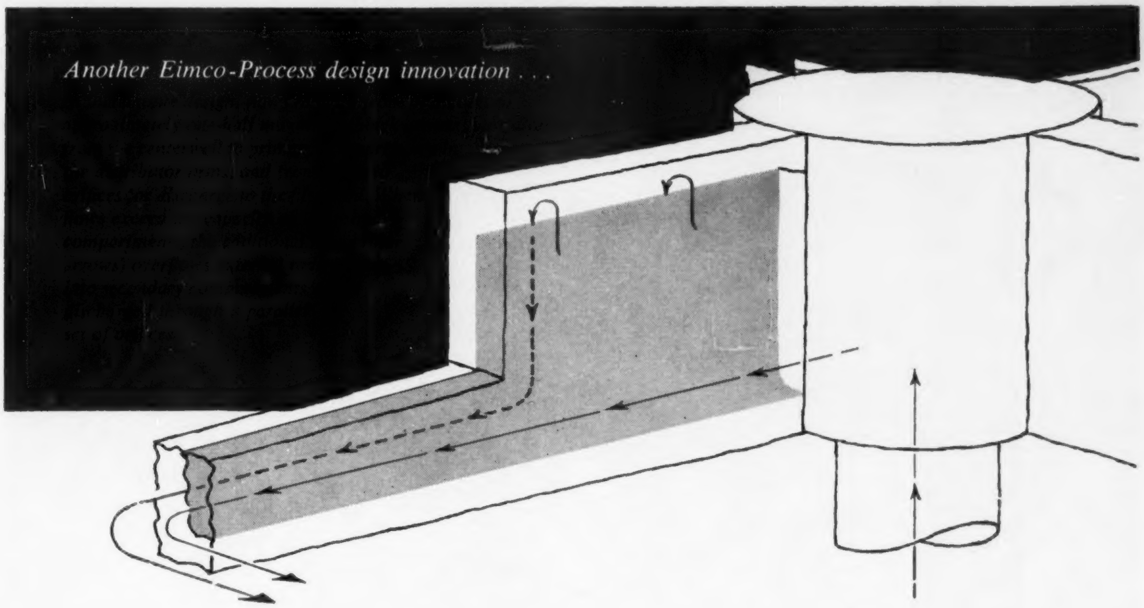
PIPE NEWLY CAST . . . 24" diameter and 18 feet long rolls out on skids from centrifugal casting machine.



SCIENTIFIC TESTING . . . Determining the chemical properties of U. S. Pipe, one of many quality checks.

INDUSTRIAL SERVICE ® CAST IRON

Birmingham 2, Ala. *A wholly integrated producer from mines and blast furnaces to finished pipe.*



EIMCO-PROCESS RADIAL WEIR ROTARY DISTRIBUTOR HANDLES WIDE RANGE OF FLOW RATIOS AT LOW HEAD

Two common problems in high rate biological filtration are widely varying flow rates and low available hydraulic head. Both are solved by this exclusive Eimco-Process design that provides external radial flow division sections and compartmented arms to efficiently handle both high and low flows at a relatively constant low head. The design is suitable for either two or four arm construction with all arms discharging at all times.

This is only one of the superior Eimco-Process Rotary Distributor types available for all bed sizes and for influent column diameters ranging from 8 to 60 inches. Mechanisms for both standard and high rate filtration are included, with or without internal flow control provisions, with pipe or rectangular steel plate arms, and with a choice of seals. For recommendations on your application, please contact any of our nationwide sales offices.

THE EIMCO CORPORATION

Process Engineers, Inc. Division
420 Peninsular Avenue, San Mateo, California

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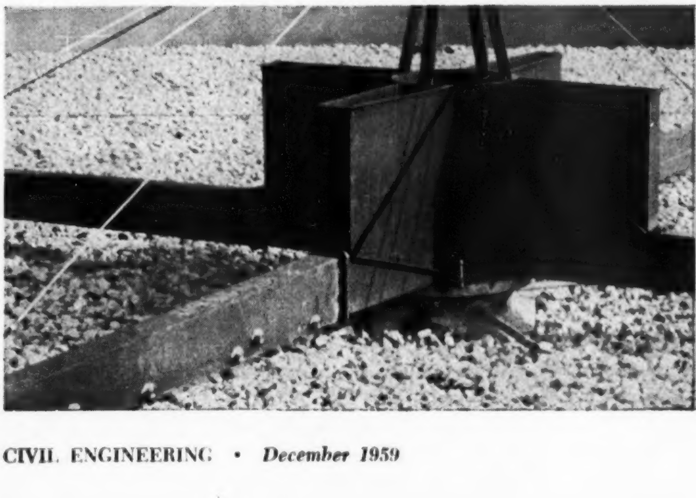


. . . another outstanding installation

Radial weir center assembly on a 102 ft. dia. high rate Rotary Distributor installed at the Arlington, Texas, Sewage Treatment Plant. Consulting Engineers—Reaves and Gregory, Fort Worth, Texas. All types of Eimco-Process Rotary Distributors are described in our new bulletin SM-1011 . . . a copy is yours on request.

Installed in 1909 —
Springfield's steel main is still on the job

Things have changed in the waterworks field since '09. But, as the photo shows, even then they were using large-diameter steel pipe in Springfield, Massachusetts.

This 42-in. lockbar steel main carries water some 22,000 ft from Provin Mountain Reservoir in West Springfield across the Connecticut River and into the City. Now in its fiftieth year, it is expected to give many more years of service. And in a half-century it has required very little maintenance.

Another major line, of 54-in. and 48-in. welded steel, with riveted joints, was laid between the reservoir and the city in 1928-1929. It's described as "in excellent shape" today.

The most recent tests indicated the H & W flow coefficients to be 111 for the 1909 line, 140 for the 1928-1929 line, and 143 for another steel line laid in 1949. According to the Municipal Water Works: "These tests showed that steel lines with proper coatings will give very long life as far as carrying capacity is concerned."

Scores of old steel mains are still in service throughout the nation. By present-day standards they were crudely constructed, inadequately protected. If they could give fifty or more years of steady, reliable service, think what today's steel pipe can do—lined and coated with modern coal-tar enamel.

Make your next main a *steel* main. The Bethlehem sales office nearest you will gladly give you full details on the advantages of steel pipe.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

Export Distributor:
Bethlehem Steel Export Corporation

BETHLEHEM STEEL

NEWS OF MEMBERS

E. Alfred Picardi, for the past five years associate and chief structural engineer with Bellman, Gillett and Richards, Toledo, Ohio, architects, has been named chief structural engineer for Skidmore, Owings & Merrill, Chicago architects-engineers. He is experienced in concrete and steel design and construction techniques.

Norman M. Pritchett has been selected for a Samuel A. Greeley Service Award by the American Public Works Association for thirty years of continuous service with the Maryland State Roads Commission. Mr. Pritchett has been chief engineer of the Commission since 1953. During his tenure as chief engineer the U. S. Bureau of Public Roads has selected two Maryland roads—out of five in the entire nation—as models for the Interstate System.

Paul Andersen, professor of structural engineering at the University of Minnesota, has been elected to honorary membership in the Korean Society of Civil Engineers. Dr. Andersen has completed a survey of the Engineering College of Seoul National University and made recommendations for its future expansion.

A. A. Brielmaier, after a six-month leave for study of German structural practice, has resumed his position as professor of civil engineering at Washington University, St. Louis, Mo. His time abroad was divided between the consulting offices of Prof. Dr. Ing. A. Mehmel and Donges Stahlbau, both in Darmstadt.

Frank B. Cook, chief of the general engineering branch of the Bureau of Reclamation's technical headquarters at Denver, Colo., retired on October 31 after twenty-seven years in Government service. In the early 1940's Mr. Cook was responsible for coordinating work on the huge Grand Coulee Dam on the Columbia River in Washington. He will open a general consulting practice in the field of reclamation and power development, with headquarters in Denver.

William G. Hamlin will assist in the formulation and presentation of specialized technical training courses in his new capacity as waste control specialist on the training program staff of the Robert A. Taft Sanitary Engineering Center, for the U. S. Public Health Service at Cincinnati, Ohio. Mr. Hamlin recently completed an industrial waste investigation for Alfred Le Feber and Associates, of Cincinnati.

Francis T. Sendker, formerly sales representative for the Alpha Portland Cement Company in the Syracuse, N. Y., area, has been named New England District sales manager by the company. Mr. Sendker will have his headquarters in Boston.

Frank Kerekes, dean of the Michigan College of Mining and Technology, has been awarded the Department of the Army's Certificate of Appreciation for Patriotic Civilian Service "For outstanding service to the United States Army

Seen at fifth annual convention of the Prestressed Concrete Institute, held at Miami Beach, November 1-7, are (left to right) Conference Chairman Charles C. Zollman and Russell E. Horn, Fellows ASCE; Senator Albert D. Gore of Tennessee; and Randall M. DuBois, newly elected president of the Institute. Senator Gore gave the keynote address during the opening session of the convention.

during peacetime and contributing to the successful accomplishment of the Army's mission." In his thirty-eight years as an educator he has given significant support to civilian military education programs, especially the Army's ROTC.

James E. Wagner, a recent recipient of a master's degree from the University of Virginia, has joined the engineering staff of the Port Arthur (Tex.) Works of Texaco, Inc. For two years, 1955 to 1957, Mr. Wagner was on active duty in the Corps of Engineers.

William R. Osgood, professor of mechanics and head of the department at Rensselaer Polytechnic Institute, will retire June 30, 1960. Professor Osgood previously taught at the Illinois Institute of Technology and the Massachusetts Institute of Technology.

Frederick C. Gardner, president since 1954 of Ebasco Services Inc., New York City, and **Max H. Foley,** chairman of the New York City Board of Standards and Appeals, were both honored for distinguished services to their profession at the recent annual meeting of the New York Chapter of the New York State Society of Professional Engineers. The double award recognized Mr. Gardner as an engineer who has made a notable career in the business world and Mr. Foley as an engineer who has given up the advantages of private practice for public service. Mr. Foley is the first recipient of his award.

F. C. Gardner

Max H. Foley

T. J. Montgomery, after twenty-seven years with the City of Cincinnati, retired as city engineer on October 23. During this period, he has served as assistant of highway maintenance, acting superintendent of Cincinnati General Hospital, principal construction engineer, and for the past ten years as city engineer. Mr. Montgomery will spend his retirement years in the St. Petersburg, Fla., area.

Rolf Eliassen, professor of sanitary engineering at the Massachusetts Institute of Technology, has gone to Vienna to set up a research program on the disposal of radioactive wastes for the International Atomic Energy Agency at its headquarters there. An authority on stream and air pollution, Dr. Eliassen has worked for twelve years on the problems of radioactive waste disposal. While abroad he will also participate in an international conference on radioactive wastes disposal in Monaco, co-sponsored by the agency and UNESCO.

James H. Spouse, Jr., is now office manager of the new branch office opened by the Master Builders Company in Oklahoma City, Okla., in a major expansion move. Mr. Sprouse joined Master Builders in 1955 and prior to his new appointment was the firm's field sales engineer in Texas, Oklahoma and New Mexico.

Werner N. Grune, since 1952 a member of the civil engineering staff at the Georgia Institute of Technology, was recently promoted to the rank of professor. Most of Dr. Grune's time has been devoted to sanitary engineering teaching and research on sewage and industrial waste, especially disposal of atomic waste on which he has worked since 1948.

(Continued on page 24)

News of Members

(Continued from page 23)

Alfred C. Klahre has left the Hawaii Highway Department, Honolulu, where he has been project engineer since 1956, to become staff engineer for the Hawaii Aeronautics Commission, with headquarters in the same city.

James T. Holden has been appointed Ohio division engineer of the National Corrugated Metal Pipe Association, with headquarters in Columbus. During the past two years Mr. Holden has been with Palmer and Baker, consulting engineers of Mobile, Ala., as supervisor of design of interstate highways in Alabama and Louisiana.

Carl B. Jansen, on December 1, became chairman of the board and chief executive officer of the Dravo Corporation, Pittsburgh. Mr. Jansen, who has been president since 1946, began his career with Dravo over thirty-five years ago as a field engineer. In addition, he is a director of Dravo subsidiaries, Union Barge Line Corporation, Dravo-Doyle Company and Dravo of Canada Ltd.

Garland L. Rounds retired on October 8 as director of the engineering branch of the Housing and Home Finance Agency's Community Facilities Administration, Washington, D. C. His retirement brought to an end eighteen years' service as director of the engineering branch and thirty-three years of government service.

Richard Pian, John E. Lyons and **John W. Klock** have joined the engineering faculty of the Arizona State University at Tempe as professor and assistant professors respectively. Mr. Pian has been associate professor of civil engineering at Michigan State Univerity for the past eleven years, while Mr. Lyons for the past several years has worked as civil engineer for the Esso Research and Engineering Company. Mr. Klock recently earned his Ph.D. in sanitary engineering at the University of California.

George Winter, head of the department of structural engineering at Cornell University, and **William McGuire,** associate professor of civil engineering there, are engaged in preliminary design of a powerful radar to explore the earth's upper atmosphere—the ionosphere—and surrounding space, which Cornell plans to construct and operate for the Defense Department in Puerto Rico. The radar consists of a powerful transmitter, a sensitive receiving system, and an antenna larger than any now known to exist.

Theodore Van Zelst has been elected vice president of Cenco Instruments Corporation, Chicago, Ill., and a director of Central Scientific Company, a Cenco subsidiary. He is also president of Soiltest, Inc., which Cenco acquired in June of this year. Mr. Van Zelst, who was sole owner of Soiltest, started the company in 1946 while he was a graduate student at Northwestern Technological Institute.

Daniel M. Kramer, chief engineer for the Delaware River Port Authority, Camden, N. J., has received a merit award from the Alumni Federation of Carnegie Institute of Technology for outstanding contribution to engineering. Mr. Kramer has been with the Delaware River Port Authority and its predecessor agency, the Delaware River Bridge Joint Commission, much of the time since 1930.

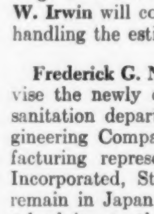
Charles F. Craig now directs the newly expanded sales and engineering staff of the Portland, Ore., office of J. H. Baxter & Company as district manager. He was formerly assistant district manager at Portland. The expansion is the result of the consolidation of the firm's Eugene and Portland sales offices. **Albert W. Irwin** will continue as office engineer handling the estimating and detailing.

Frederick G. Nelson will assist and advise the newly organized environmental sanitation department of the Sanki Engineering Company in Tokyo as manufacturing representative of Dorr-Oliver Incorporated, Stamford, Conn. He will remain in Japan for one year as technical adviser to the Tokyo firm. Mr. Nelson has been with Dorr-Oliver since 1928.

Leslie W. Pillar, formerly vice president of De Leuw, Cather & Company of Canada Ltd., has been named president. The firm maintains offices in Toronto and Ottawa.

Eugene A. Wirkus has been appointed field engineer on the Metropolitan Los Angeles staff of the Portland Cement Association. Mr. Wirkus was formerly an associate highway engineer in the design department of the California Division of Highways in Los Angeles.

John C. King has been named product development engineer for the Master Builders Company, a division of the American-Marietta Company, with headquarters in Cleveland, Ohio. As chief engineer until recently for Instrusion-Prepakt, Inc., of Cleveland, he was engaged on such important works as the Kitimat-Kemano Power Project.



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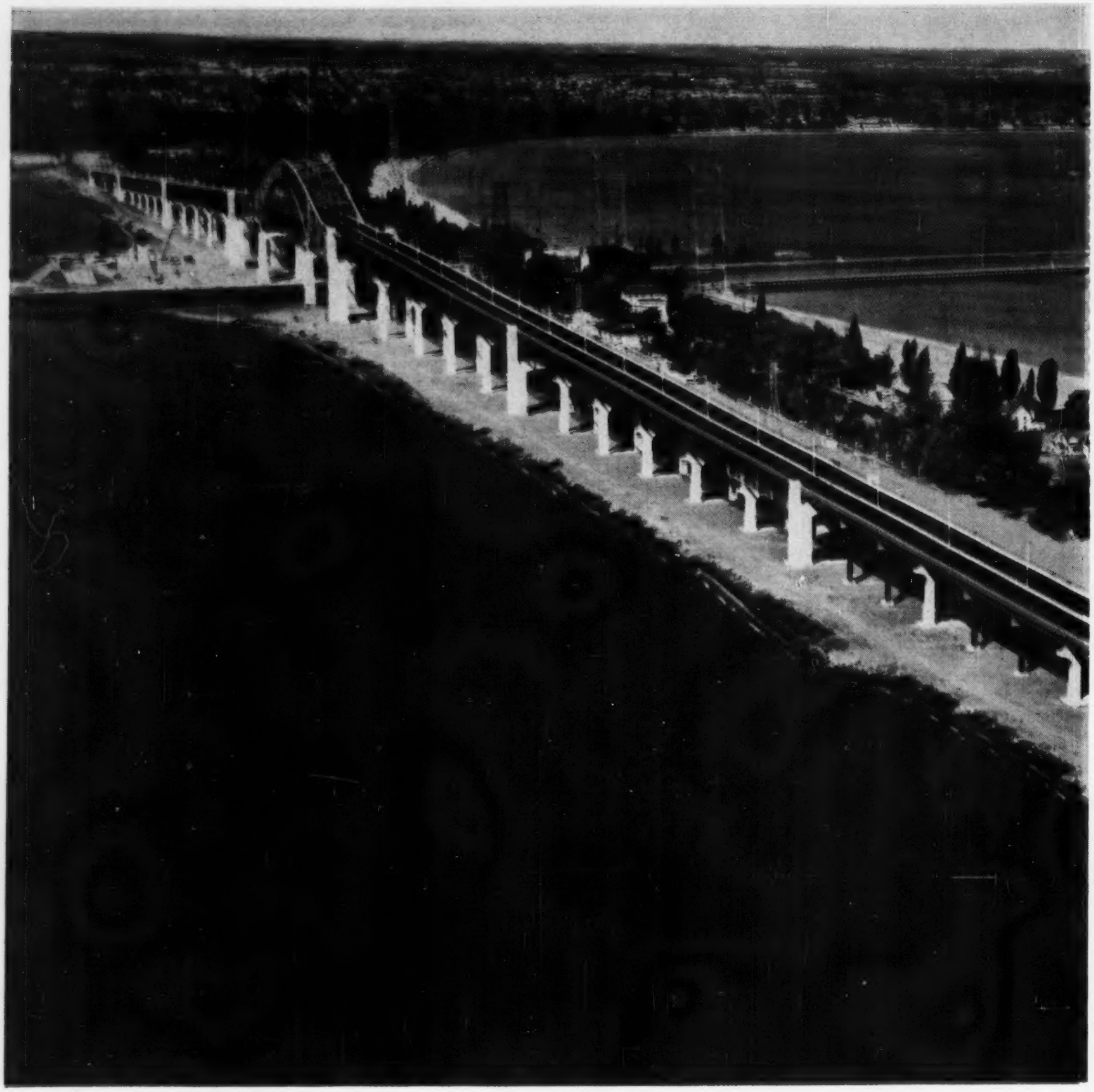
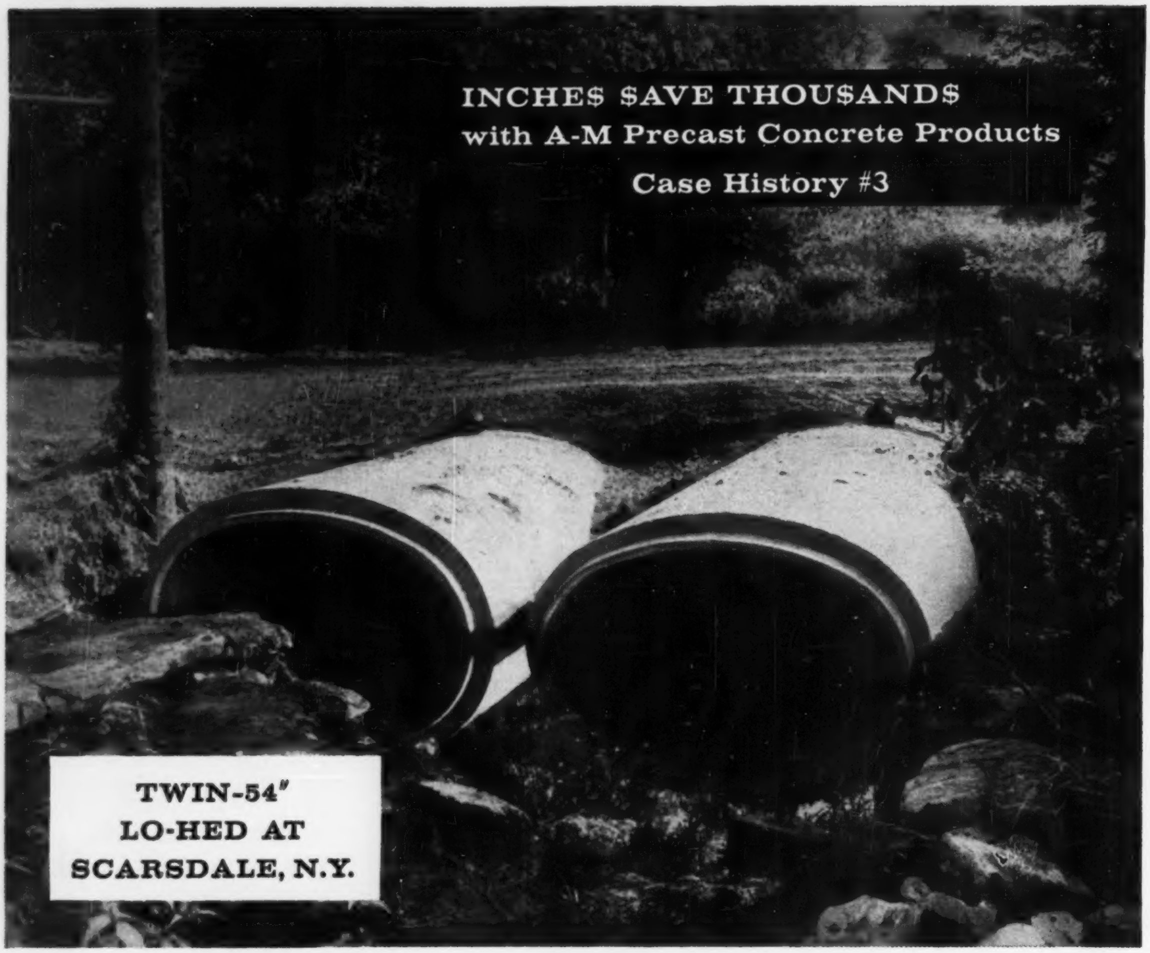
MAN-TEN High-Strength Steel saves 600 tons



Burlington Bay Skyway. Owner: Ontario Department of Highways. Designer: Foundation of Canada Engineering Corporation Limited. 22-span fabricator and erector: Runnymede Steel Construction Limited.

3,000 tons of USS MAN-TEN High-Strength Steel were used in 22 deck-truss type spans to reduce weight and costs of the Burlington Bay Skyway. MAN-TEN Steel is shown in color in the typical deck-truss span drawing at the right. Because each truss for the 250-foot spans weighed 110 tons rather than 130 tons, it was possible to erect a complete truss in one piece with only two cranes. This materially reduced erection costs.

New color movie available—"Challenge at Carquinez." A 27-minute, 16mm. color film showing the design and construction of the unique Carquinez Straits Bridge. Ideal for engineering groups. For booking information, write United States Steel, Pittsburgh Film Distributing Center, 525 William Penn Place, Pittsburgh 30, Pennsylvania.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. . . . . Am-Soc Briefs

▶ ▶ Inspired, possibly, by the groundbreaking for the United Engineering Center on October 1, ASCE members made October a $50,000 month in the drive for funds. Three New England Sections-Connecticut, Maine, and Rhode Island--are the newcomers to the UEC Honor Roll, bringing the total to twenty-seven. . . . Way out in front are Districts 1 and 9 with 99 percent of their quotas subscribed. District 4, it will be recalled, met its quota long ago. Zone I, currently standing at 96 percent, is ahead of the other Zones.

▶ ▶ Congratulations . . . To the Illinois Section for its enterprise in sponsoring a series of TV programs this fall devoted to "Careers in Civil Engineering." . . . To the Metropolitan Section for the bright idea of a Guide Committee that will show New York City sights to visitors (details in the Society News section). . . . In the news last month (page 77) were the San Francisco Section, which is surveying 1,600 Bay area civil engineers with the aim of reducing rising construction costs, and the three Washington Sections (Seattle, Spokane, and Tacoma), which have been instrumental in getting the state to launch a needed water resources study.

▶ ▶ Curricula and careers. . . . ASCE is carrying the ball in current attempts to improve civil engineering education by promoting a series of curricula study conferences, discussed in Society News. . . . Another important activity of the Committee on Engineering Education is revision of the booklet, "Your Future in Civil Engineering," which is prepared for the college freshman and sophomore, but is also a valuable guide for the high school junior and senior. The booklet is being distributed to all engineering schools with civil engineering programs. Later distribution to high schools and Local Sections is planned.

▶ ▶ Plans for the 1960 Nuclear Congress, set for the New York Coliseum, April 4-8, are shaping up. ASCE will be congress manager this time, while EJC as usual will coordinate the programs of the many participating societies.

▶ ▶ On the agenda for next spring is a new ASCE Membership Directory, the first in two years. . . . If there has been any change in your listing in the 1958 Directory--have you moved, changed jobs, or been promoted?--be sure to inform Society headquarters (coupon on page 124).

▶ ▶ Engineers Joint Council has taken a big step toward establishing a means of direct communication with each of the 300,000 members of its constituent societies by allocating $15,000 to get the project underway. ASCE has long promoted the idea of a publication that would go to most engineers in the country. The plan is to cover news of a professional nature, proposed legislation affecting engineers, educational advances, and the like. At the start it may be a quarterly. . . . On a pro tem basis, in the meantime, EJC has launched a trial newsheet described in Society News, for distribution to officers of its affiliated groups.

do you know that

Modern dome construction is actually very old? Circular roofs go back to primitive times and were in use in Greece and Italy long before Christ. For a thousand years the dome was the symbol of church architecture, Moslem and Christian. Since the building of the cast-iron dome for the U. S. Capitol in Washington in 1865, domes have been fashionable for government buildings, too. Union Tank Car's recently completed 384-ft-dia geodesic dome at Baton Rouge, La., is the first example of a large dome to house an industrial facility. Union Tank Car has just completed a similar dome at Wood River, Ill., supported during construction on air. The new dome is featured in an article in this issue.

▪ ▪ ▪

In its first year of operation the St. Lawrence Seaway has spurred river travel? In the current navigation season (to the end of October) 17,400,000 tons of cargo were carried on the Montreal-Lake Ontario stretch of the Seaway—a 72 percent increase over tonnage passing through the old St. Lawrence canals in 1958.

▪ ▪ ▪

U. S. copper reserves are estimated at 32½ million tons? This is enough to last thirty years at the present annual production rate of 1.1 million tons. The estimate is the result of a joint study made by the U. S. Geological Survey and the Bureau of Mines.

▪ ▪ ▪

The world's biggest power dam will be built on the Yangtze? Members of a U. S. Senate group, who have been inspecting Soviet hydroelectric projects, say that the Soviet Union and Communist China will cooperate to build a mammoth power dam in the Ichang Gorges of the Yangtze. The projected 25,000,000-kw project would be twelve times larger than Grand Coulee Dam, biggest in the United States, and six times larger than Bratsk Dam in Siberia, largest in the Soviet Union. About twenty years will be required to build it. The project recalls the fact that during the war the Nationalist China Government commissioned ASCE Honorary Member John L. Savage, then chief designer for the Bureau of Reclamation, to plan a large power dam for the same site.

▪ ▪ ▪

High strength bolts have almost replaced rivets in field construction of buildings and bridges? The ready acceptance of this construction technique in the eight years since it was introduced is attributed to confidence in the specifications drawn up by such groups as the Research Council on Riveted and Bolted Structural Joints. Standardization experts predict that the working strength of high strength bolts will be increased, and that in another eight years the rivet will be as much a rarity in the shop as it is today in the field.

▪ ▪ ▪

Engineers' starting salaries were up in 1959? A survey of ten leading colleges—from MIT to UCLA—shows a 4 percent gain over 1958 starting salaries and a 10 percent gain over 1957. Electrical engineering graduates were again in top place with starting salary range of \$510 to \$550. Second place was held by aeronautical engineers (\$482 to \$535); third place by mechanicals (\$490 to \$525); and fourth place by chemical and industrial graduates (\$480 to \$510). Civil engineering graduates, with salary range of \$470 to \$510, were again the low men. All graduates listed type of work, rather than salary, as their prime concern in looking for jobs.

▪ ▪ ▪

Geological irregularities in the English Channel floor may hamper the tunnel? Latest word about the controversial tunnel is that it will have to swing like a roller coaster to avoid the uneven rock layers in the Channel bed. These detours would add at least ten more miles to the planned 22-mile route. Wimpey Laboratories, a British contracting company, has just completed a geological survey of the proposed route, using an electrical device developed by the Woods Hole Oceanographic Institute on Cape Cod.

▪ ▪ ▪

Output per man-hour in the steel industry has lagged far behind that of other U.S. workers in the past decade? The situation—reported by Secretary of Labor Mitchell —is attributed to the restrictions of "an outmoded labor contract," by R. Conrad Cooper, executive vice-president of U. S. Steel. Mr. Conrad points out that the steel industry has spent some \$12 billion since the war for new and improved tools of production and that "its workers are as skilled and efficient as any in the country."

▪ ▪ ▪

Vehicular travel is ever on the increase in the U. S.? Data compiled by the Bureau of Public Roads indicate that there were 665 billion vehicle-miles of travel in the U. S. in 1958. The 1959 forecast is nearly 700 billion vehicle-miles. The good roads we need for travel like this will be the subject of a special highway issue scheduled for January.

A new approach to local flood problems

HERBERT D. VOGEL, F. ASCE, Brig. Gen., U.S. Army Ret.

Chairman of the Board of Directors, Tennessee Valley Authority, Knoxville, Tenn.

Communities throughout the nation are engaged in a new contest with their rivers and they are losing. They will continue to lose unless steps are taken to provide a new perspective—and a new channel of action—with respect to floods."

This quotation is from a special report sent to Congress by the Tennessee Valley Authority in the early spring of 1959. Later, in May, Brig. Gen. John L. Person, F.ASCE, Assistant Chief of Engineers for Civil Works, made the following remarks in testimony before the House Committee on Public Works:

"While we have made great progress in providing flood control works, many of our river valleys are still subject to destructive floods, and the degree of protection varies widely. Moreover, it will probably not be possible, because of physical and economical limitations, to provide full flood protection. This leads to the inescapable conclusion that greater attention must be given by states, municipalities, and industry, and by the federal agencies concerned with development, to some form of regulation of flood plain use. . . . We should be as much concerned with avoidance of creating a future flood hazard, as with means of correcting the damage after it occurs."

Behind this statement is the fact that engineers and public officials concerned with our rivers and their development are taking a new look at an old problem—the problem of preventing the damage, the suffering and the economic dislocation caused by swollen, flooding streams.

The 50-year record of flood damages since 1902 shows that in spite of all our nation's effort at flood control, the average annual losses have increased rather than decreased, even when adjusted to the changes in the value of the dollar. Even more significant, the losses during the last half of this period were twice as great as those in the first half.

The difficulty is not that we have not built well. Some of the world's finest engineering achievements in flood control are right in this country. Rather, the difficulty lies in the ever-changing nature of the use of the flood plain as our growing population moves about in response to altered social and economic conditions. Between 1900 and 1950 the number of urban places, as defined by the U.S. Census, increased from 1,737 to 4,023. Since 1930 alone, the population of the United States has increased by 52,000,000, and nearly all the increase has occurred in urban areas and on their fringes. Current evidence indicates that our population in 1975 will be some 55,000,000 greater than it is today. And again, almost all this growth will be in and around the cities and towns.

These forces create powerful and irresistible demands for land for homes, shopping centers, and commercial and industrial plants, spreading and radiating far beyond the formal boundaries of our present cities. In many cases, the most attractive land, and the land that seems subject to development most economically, is in the level river valleys where the flood hazard is greatest.

In the past five years, a dozen or more states have felt the serious and damaging consequences of flood plain development. You can tick them off from memory: Connecticut, Massachusetts, New York, Pennsylvania, Indiana, Illinois, Texas, Kentucky, Kansas, California, Ohio and Missouri.

Not only along the rivers but also along the low lying coastal areas have population pressures brought a steady increase in the flood damage potential. These are the areas vulnerable to abnormal tides and waves, pushed on shore by hurricanes, which batter and flood structures built too close to the sea. Again you can check off the recent disasters that were headlined nationally: Rhode Island in 1954, North Carolina in 1955, and Louisiana in 1957.

Communities faced with these population pressures are confronted at the same time with forces pressing on them from another direction. With a national government hard pressed to meet the financial requirements of defense and the bolstering of the free world, and with state governments pushed to meet the essential expenditures required for such vital programs as education and highways, the funds we have been able to find for protective structures along our rivers have been inadequate to keep pace with the growth of areas needing protection. At present rates of construction, projects now authorized cannot be completed in less than 25 to 30 years. In the meantime new floods will descend and new areas will be built up to be destroyed by them—unless steps are taken to avoid this result. Time works against us. No matter how energetically we build, we fall further behind in our task.

This is a situation which, by its very nature, is best understood by the engineer. It is therefore a situation in which engineering leadership in its broadest sense is urgently required. We are faced with a combination of physical facts that add up to a growing peril for our valley-dwelling people and to a growing financial burden for the Federal Government. It is an obligation, therefore, of the engineering profession to make it clear, far and wide, that a new approach to flood problems is essential and that time is of the essence

in getting new programs in operation.

The modern sciences of meteorology and hydrology make it possible to determine with fair precision the kinds of storms a region can expect, the volume of water that will fall as rain, and how quickly it will descend from the hills and mass itself with titanic force on the flood plains below. We can determine the areas the water will cover. The only element of conjecture in our analysis is the timing. We know that these great floods can come any time—in ten years or not for a hundred years. Or they may come this year and next year too.

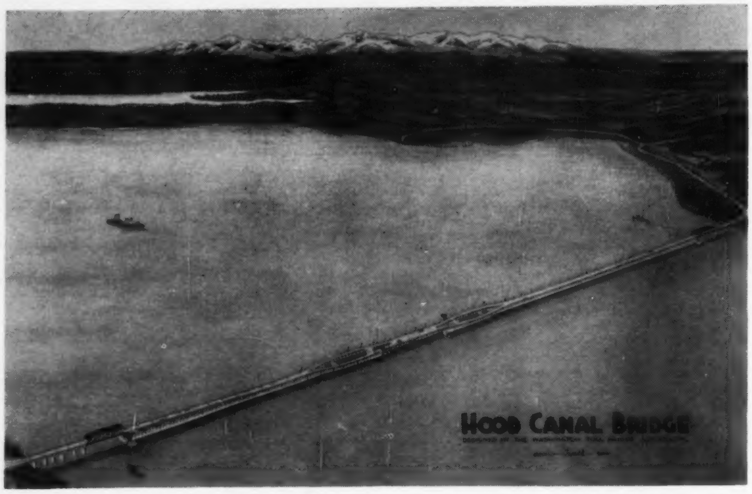
With these valuable sciences at our command, we must not limit our flood damage avoidance programs to control measures alone. We can use our knowledge to guide the surging growth of urban areas into locations that are safe from floods. Thus, we can lick the flood problem in large part by keeping people out of the pathways of the waters.

Our experience in the Tennessee Valley in avoiding damage from floods that cannot be controlled—except by extremely large and probably unwarranted expenditures—reveals techniques believed to be adaptable to other states and localities. The widespread use of these techniques can save lives and property beyond our ability to estimate, and can at the same time lessen the pressure on the federal treasury for local flood-control construction.

The local government must appraise the local flood problem and determine the best solution, preparing and executing the necessary plans to accomplish that purpose. Engineering skills are essential in this process. The local officials are the individuals who must establish flood plain regulations in a manner that will receive public acceptance and at the same time guide building away from areas of flood hazard. Here again, the counsel of trained engineers is most important. These same officials must be prepared to withstand pressures from special interests, which may seek to overthrow or make exceptions to the regulations. Further, they must create a continuing awareness of the flood problem on the part of the public, and particularly on the part of planners, developers, and builders.

As foresters have taught us to exert our primary efforts toward preventing fires rather than suppressing them once they have started, so engineers can educate America to this new truth with respect to floods—that the avoidance of flood damage goes hand in hand with flood *control*.

(This article is based on General Vogel's address presented at the Hydraulics Division Conference last July, at Fort Collins, Colo.)



Artist's drawing of Hood Canal Bridge shows floating section with 600-ft draw span. At each end of the floating section, a steel-truss transition span makes the connection to the fixed approach.

A floating highway bridge 6,470 ft long

CHARLES E. ANDREW, F. ASCE, Chief Consulting Engineer

Washington Toll Bridge Authority, Olympia, Wash.

Floating, reinforced-concrete pontoons, extending for nearly a mile and a half, carry a two-lane highway across a natural arm of Puget Sound called the Hood Canal, in the State of Washington. Twenty-three pontoons will be bolted together to form the 6,470-ft-long floating structure. The pontoons have a width of 50 ft and a length of up to 360 ft. At each end of the floating part of the bridge there will be a 280-ft steel transition span, hinged to adjust for an 18-ft rise and fall of the tide, and connected with fixed girder spans extending out from the shore. A feature of the unusual bridge is a 600-ft draw span near the middle to provide for passage of large ships. The draw span operates by withdrawing two of the pontoons horizontally between parallel guide pontoons.

The Hood Canal Bridge, with a total length of 7,866 ft, will replace the Lofall-South Point ferry by forming a connection between Highways 21 and 101 through 9E leading to the northern part of the Olympic Peninsula.

In the design and construction of the floating structure, many unusual and unprecedented physical conditions were present which had not been met before in floating-bridge construction. Among these problems were the following:

1. Throughout the length of the floating structure, water depths at mean low tide vary from 70 ft to 340 ft. The 70-ft depth at the ends drop quickly to over 100 ft and then gradually to 340 ft at the center. These depths of water led to the selection of a floating type of structure for the major part of the bridge.

2. The floating structure is subject to a tidal range between extreme low and extreme high water of 18 ft and an extreme tidal velocity of 2.5 miles per hour.

3. Maximum wind gusts at the site reach about 80 miles an hour and choppy wave action, involving 5-ft waves with a 35-ft crest length, has been observed.

4. The canal is used by the largest aircraft carriers, which load and unload ammunition at the depot at Bangor, Wash., several miles to the south of the bridge. A channel opening 600 ft wide in the deep water near the center of the bridge was required for the passage of such craft.

While many unique problems were encountered in the design and construction of the floating structure, the approach structures, in contrast, are of conventional design and entailed no unusual problems in construction. At each end the floating structure is connected to the fixed approach by a steel transition truss. The fixed approaches consist of continuous welded steel girders with a composite deck of lightweight concrete. For the east approach, two three-span girder units with spans of 95 ft, 130 ft and 95 ft were used. For the west approach, one two-span unit with spans of 95 ft was used. The girders are supported on concrete piers, which on the east side are founded on hardpan, and on the west side on piling driven to rock.

Traffic engineers reported that a two-lane structure would be sufficient to accommodate all the traffic that could be expected to develop within the foreseeable future. Consequently a 28-ft clear roadway with 2-ft service walks was provided. To protect vehicles on the bridge from salt-water spray, the roadway is elevated 20 ft above the water line by the construction of an open trestle throughout the major part of the structure, the roadway deck being 14.4 ft above the top deck of the pontoon. Toward each end of the floating structure, the deck rises to greater heights above the water to meet the secondary fixed channel spans provided for the passage of tugs and small craft.

Pontoon assembly

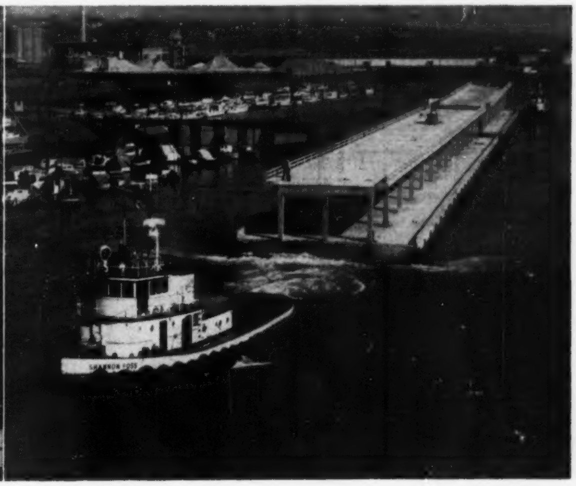
Each pontoon is divided into cells measuring 15 ft longitudinally and 12.5 ft transversely. The bottom slab and exterior walls are 9 in. thick, the top slab is 7 in. thick, and the interior longitudinal and transverse walls are 6 in. thick. Alternate transverse walls are watertight. The typical pontoon has a draft of 8.65 ft. Adjacent pontoons are bolted together with 1½-in. round high-strength bolts spaced around the perimeter of the pontoons about 15 in. on centers. The bolts pass through heavy concrete beams formed into the body of the pontoon just inside the top and bottom slabs and the side walls. Large shear keys are provided at the bolted connections. Rubber seals are placed just outside the bolt lines to extend above the water line.

The process of assembling the pontoons in the field consists essentially of moving two pontoons together end to end, attaching the anchor cables, compressing the rubber seals by installing the bolts above the water line and drawing the pontoons together, to within 1½ in. of each other. Water is then pumped from the intervening space, made watertight by the rubber seals, through suction pipes inserted between the adjoining pontoons. Next, the plugs are removed from the bolt holes below water, and the remaining bolts are installed and given an initial tension. The 1½-in. space remaining between the pontoons is filled with grout, which is allowed to set. The bolts are then tensioned to a specified stress.

In this way, a continuous beam approximately 3,448 ft long was formed on the west side of the draw span, and another 2,418 ft long on the east side of the draw span. Each of these continuous pontoon sections is connected longitudinally to the outboard piers by means of a longitudinal strut in the transition spans. This strut is in the plane of the bottom chords and extends from the pier wind shoe to the tower wind shoe on the floating structure. This strut transmits longitudinal forces from the floating structure to the outboard piers. Longitudinal expansion and contraction are provided for at the central draw span.

To resist lateral forces due to tide, wind, and wave, the bridge is anchored by bridge-strand cables attached to the pontoons and to heavy concrete-filled anchors resting on the canal bottom. In all, there are 42 of these gravity anchors, each weighing 550 tons submerged. These anchors, opposing each other in pairs, are attached to the bridge by a loop of 1¾-in. bridge strand (made up of two strands) running around a special strand shoe 4 ft in diameter at the anchor and to an adjustment mechanism which provides approximately 12 ft of adjustment within the pontoon. The point of attachment is at the center of each 360-ft pontoon section.

Graving dock in the Duwamish Waterway (below left) was widened to accommodate two pontoons. Here work is progressing on twelve anchors, a draw pontoon at near center and a cross pontoon at far center. Traveling work-bridge is in foreground. In photo at right, two pontoons bolted together, with a total length of 720 ft. are on the way to the bridge site.



The wires in the outside layer of the strand are triple galvanized, the inside wires are single galvanized, and the interstices between wires are filled with a coal-tar pitch. The strand is continuous through the loop, thereby eliminating any socket connections in salt water. The strand loop was used so that a new strand could be pulled in by means of the original strand should it become necessary to replace the cables in the future. Cathodic protection against corrosion is provided by the use of an impressed current and carbon electrodes.

Design of the anchor cables was somewhat involved because of the tidal range. The cables act as long steel springs, the variation in tide level being absorbed by changes in the sag and in the length of the cable. All cables were designed to have the same maximum stress at high tide considering the design wind and wave forces acting on the structure. The angle of inclination of the cable was adjusted so that the maximum stress in the two strands of the loop will not exceed 400 kips. The minimum stress in any loop on the leeward side of the structure at low tide is 20 kips. The angle of inclination of the cables at the pontoon varies from about 6 deg at the ends of the structure to 17 deg at the center. The corresponding horizontal distances between the face of the anchor and the centerline of the bridge vary from 610 ft to 1,220 ft. The maximum lateral movement of the bridge due to transverse wind and wave forces is expected to be approximately 6 ft. It is anticipated that considerable adjustment will be required to tension the cables properly. Because of tidal variations and the varying effects of winds and waves, it is difficult to estimate the correct tension at any particular time. The cables are adjusted with 100-ton hydraulic jacks.

Floating draw span

Navigation requirements are met by providing a major opening in the bridge near the center of the channel. Since the largest naval vessels, including aircraft carriers, will pass through this opening on their way to the ammunition depot at Bangor, a clear horizontal width of 600 ft is required. Such an opening far exceeds the span of any floating draw bridge constructed to date, the longest in existence being the 200-ft draw span in the present Lake Washington Bridge. Such a span naturally presented unprecedented problems in design. Generally the design consists of two draw-pontoons each composed of two parts joined together, so that each draw-pontoon is 470 ft 10 in. long.

These draw-pontoons retract each way from the center of the ship channel to provide the 600-ft clear opening. They retract into a lagoon formed by the U-shaped flanking pontoons. Submerged concrete struts, built integral with the flanking pontoons, tie the flanking pontoons together and prevent spreading due to lateral forces.

In the closed position, each draw-pontoon overlaps its respective flanking pontoons approximately 170 ft. Within this overlap, horizontal and vertical trunnions are placed approximately 147 ft apart on each side of the draw-pontoons. The vertical trunnions, which prevent vertical motion between the draw and the flanking pontoons, are fixed to the draw-pontoons and run in recessed tracks in the flanking pontoons. The horizontal trunnions, which prevent horizontal motion between the draw and the flanking pontoons, are attached to the flanking pontoons and bear against a track on the side of the draw-pontoons. When the bridge is closed, heavy mechanical shear keys transfer shear between the draw-pontoons at the center of the channel.

Electric power is used to move the draw-pontoons, the power being transmitted to the pontoons by pinions and a continuous rack. The bridge is designed to open in three minutes.

In addition to the main opening near the center of the bridge, secondary channel spans are provided under the transition spans near each shore. Each of these spans provides a horizontal clearance of 220 ft. The minimum vertical clearance for the west opening is 35 ft and that for the east opening is 55 ft. These secondary channels provide for the passage of tugs and smaller craft. They are formed by the hinged transition spans, which take care of the 18-ft variation in the tide. They are steel trusses 280 ft long, resting at the shore end on concrete piers and at the outboard end on steel towers erected on cross pontoons at the east and west ends of the floating structure.

The truss bearings are hinged at each end to permit both vertical and horizontal movement of the floating structure. To lessen the change in grade at each end of the transition spans caused by the rise and fall of the tide, the grade is broken in two places by hinging the stringers at the first floor beam from each end of the truss and extending the stringers, two panel lengths to a bearing formed into the approach, one panel length beyond the end of the truss. Thus by setting the bridge with no grade change at mean tide, the grade change at either high or low tide becomes in the order of 1.6 percent for a maximum tidal range of 18 ft. Such an extreme variation occurs only with rare combinations of wind and tide. However, a maximum range of 15 ft can be expected three months of the year.

The bridge is designed throughout for H 20 S 16 loading and in general complies with AASHO standards.

East-side transition span of the Hood Canal Bridge starts its trip to the bridge site supported by falsework on a 210-ft draw-pontoon.

Construction features

Because of the location of the structure, 35 miles north of Seattle, it was necessary from both an engineering and a construction point of view to

separate the floating structure project into two separate areas of operation, one in Seattle and the other at the bridge site.

The contractor chose to fabricate the pontoons in an existing graving dock located on tidal water in the Duwamish Waterway in the southwestern part of Seattle. The dock had to be widened to accommodate two pontoons placed side by side; it was necessary to work on two simultaneously in order to meet the schedule. The plant was well equipped with moving cranes and an adequate mixing plant for both standard-weight and lightweight concrete.

Steel forms were used for all the work except odd parts where re-use of forms could not be realized. It is believed that, with minor repairs, one set of steel forms will last for the fabrication of 19 pontoons. In fact, at the present writing, it appears that, with minor repairs, the steel forms will prove ample for the entire project. For the flanking pontoons in the draw-span area, certain modifications will be required in the steel forms, with the addition of wood forms to make the odd-shaped cells.

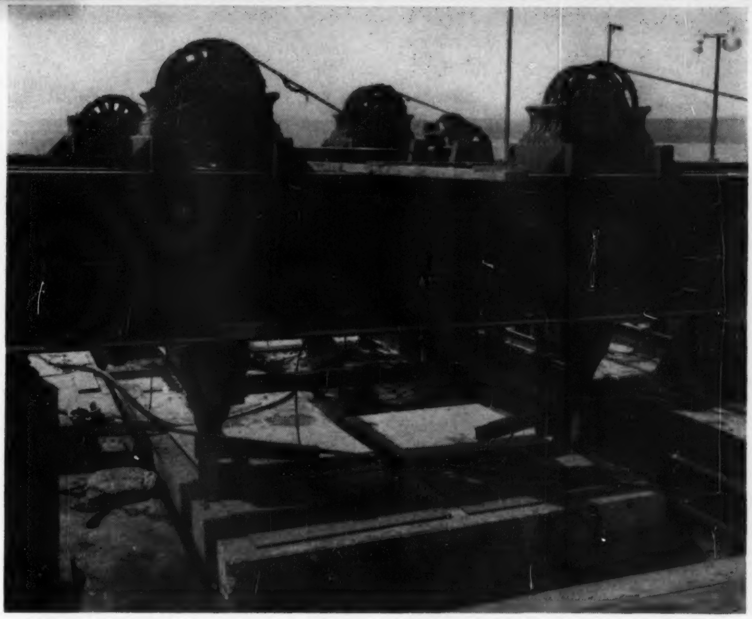
Specifications required that all concrete for the pontoons, with the exception of the top slab, should be placed in one continuous pour. For a standard pontoon, this involves placing approximately 1,310 cu yd in the first pour. After the concrete in the first pour has reached a strength of 3,000 psi, and before the top slab is poured, the pontoon is post-tensioned. The tensioning elements consist of ⅜-in. round wire strands, with from 6 to 8 strands in each tendon. Permanent end anchorages are used; in addition, the conduits are filled with grout.

Generally the top slab, which consists of three equal pours, is poured in the graving dock before the pontoon is launched. Where construction schedules warrant, the pontoon is launched and towed to an adjacent outfitting dock for pouring of the top slab. The superstructure on the pontoons is placed at this same outfitting dock.

Extreme care must be taken to hold the wall and slab to true plan dimensions so that the final drafts of the pontoons will correspond to the theoretical ones. Ballasting is used to correct variations in draft and to hold the dead-load moments in the completed structure to a minimum. The finished pontoons are towed approximately 35 miles to the bridge site.

The concrete shells for the anchors, 42 in number, are also fabricated in the graving docks, launched and towed to the bridge site.

Lowering the anchor is an interesting problem and involves heavy equipment. Each anchor weighs 550 tons submerged, after its shell has been filled with concrete. Two LSM barges, 34 ft x 200 ft x 15 ft, are set parallel and approximately 20 ft apart, held in place by structural members. On these two barges are erected two heavy girders spanning the 20-ft space between them, and 16.5 ft apart. The floating anchor shell is towed under these girders, which are high enough to clear it and its head blocks, into the exact position in which it is to be sunk. (The barges have been placed in position by triangulation.)



Heavy girders supported on two barges in turn support four falls connected to each of the four corners of an anchor block. The anchor shell is then filled with concrete and allowed to sink to the river bottom.

Four falls, two on each girder, are attached to the four lifting bars cast in the anchor shell. The falls consist of eleven parts of 1⅛-in. cable, operated by heavy hoists on the barges. The shell is then filled with concrete and allowed to sink until it is awash.

Since the concrete filling is of a relatively dry mix, no noticeable washing of cement occurs from the surface when the initial immersion is done slowly. Consequently the anchor may be lowered immediately after the filling is complete. The rate of lowering approximates 7 ft per min, and water depths to final position on the bottom vary from 70 to 340 ft. The four falls are held in workwise position at the bottom by a rectangular structural-steel frame which is attached at each corner to the bottom blocks. A lever mechanism is built in at each corner in such a manner that when a tag line running to the surface is pulled, the pin is released, disengaging the block from the anchor. As soon as the anchor has come to rest on the bottom, the falls are slacked off and the pins, which have more than a nominal pin clearance, become loose and require a relatively small force on the levers to withdraw them.

The loops of cable strand previously described are attached to the anchors before they are lowered and after lowering are laid on the bottom pointing toward the bridge centerline. These loops are picked up by buoy lines later and attached to the pontoons as they are placed in position.

The bridge is financed by Washington Toll Bridge Authority bonds guaranteed by tolls.

As of November 1, 1959, the project is approximately 70 percent complete. The final date of completion depends on weather conditions at the bridge site during the winter and early spring. For this reason a date for final completion cannot be definitely fixed at this time. It is however anticipated that the bridge will be opened for traffic during the summer of 1960.

The Electro Rust-Proofing Corporation of Belleville, N. J., designed the cathodic protection, and Thos. E. Sparling, electrical engineers of Seattle, Wash., were retained for the electrical work.

Construction is under the supervision of William A. Bugge, F. ASCE, Director of Highways, State of Washington. Charles E. Andrew, the writer, is Chief Consulting Engineer to the Washington Toll Bridge Authority. E. H. Thomas, F. ASCE, was Project Engineer until his death on December 31, 1958. Since that time, H. S. Sitzman, M. ASCE, has served as Principal Bridge Engineer.

A large high-head power development for Switzerland

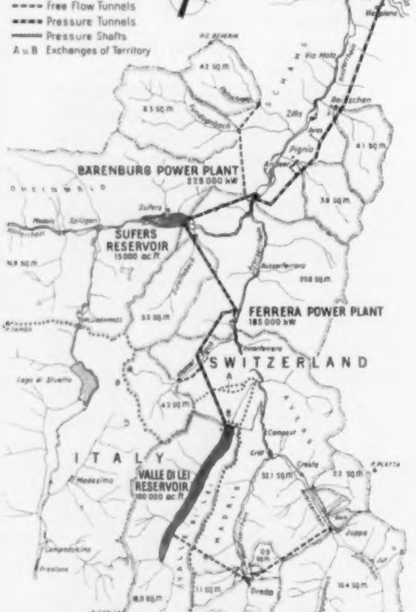
N. J. SCHNITTER, A.M. ASCE, Design Engineer in Applied Hydraulics

Motor-Columbus Ltd., Baden, Switzerland

One of the largest hydroelectric projects ever built in Switzerland is now under construction to develop the power potential of the uppermost reaches of the Rhine. This project is one of many now in process of construction to meet the country's increased demand for power.

Switzerland, like all other highly industrialized countries, has experienced a sharp rise in the demand for electric power since World War II. The average yearly rate of increase has been over 5 percent and the yearly per capita consumption is now about 3,000 kwhr—the fifth highest in the world after Norway, Canada, the United States and Sweden. Almost all the electric energy is produced hydraulically, which requires relatively large capital investments. Present yearly outlays for power-plant construction amount to over $30 per capita, or roughly 3 percent of the national income.

FIG. 1. Hinterrhein hydro project, high in the Alps, on the Swiss-Italian border, consists of three power plants and appurtenant works.



The Hinterrhein Project here described is in the eastern Alps, in the Swiss state of Grisons, on the uppermost reaches of the Rhine, that is, on its two southerly forks, the Hinterrhein and the Averserrhein. The utilized watershed covers only 200 sq miles with an average yearly runoff of 62 in. or barely 640,000 acre-ft. However one third of this runoff can be stored and, what counts most, has a total available head of over 4,000 ft.

It is this classical pattern of Alpine storage plants—low flow but high head—that accounts for the project's average yearly power production of 1.3 billion kwhr. Since the aggregate capacity of the installed turbines is almost 900,000 hp at full load, the operating time is just 2,000 hours per annum. Such a high concentration of production is considered essential because the well integrated national power grid requires storage plants to cover peak-load demands and winter production deficiencies at the run-of-river plants.

One noteworthy peculiarity of the Hinterrhein project is that its main storage reservoir floods the Italian Lei Valley. Also the dam site proper belongs to Italy, but is to become Swiss by the exchange of a small piece of territory when construction is completed. In compensation an Italian utility, the Società Edison of Milan, is participating with 20 percent in the Kraftwerke Hinterrhein A. G., the Swiss company formed to build and operate the whole project.

The 80 percent of Swiss participation is divided among the state of Grisons, the local communities conceding the water rights, and several utilities, mostly public. Although organized on a private basis similar to that of most of its public partners, the company is predominantly state and municipality owned. The energy produced as well as the operating costs are allocated to the various partners in accordance with their share holdings.

Total capital costs, including all overhead expenses and contingency allowances, are estimated at about $140 million, which brings the average cost of energy to about 7 mills per kwhr. Financing, up to 25 percent of the total costs, is from the share capital held exclusively by the partner companies. The remaining 75 percent is procured by loans from social security funds and the like and through public bond issues, the average interest rate being about 4 percent.

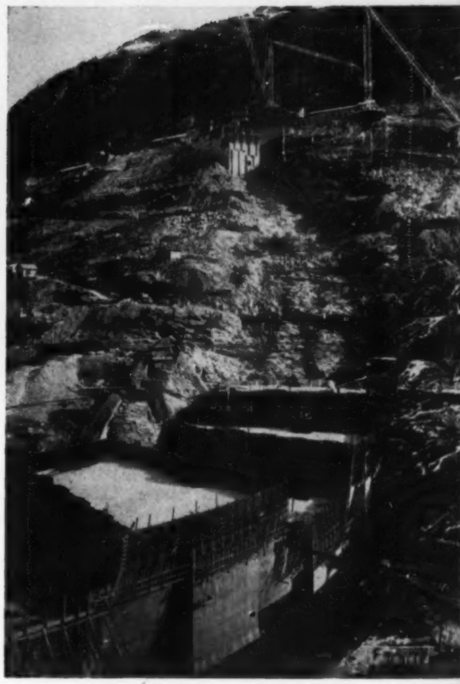
Design and supervision of construction are being carried out, on the basis of regular engineering contracts (percentage fee), by Motor-Columbus Ltd., Baden, Switzerland, for the Swiss parts of the project, and by the Società Edison of Milan for the Italian parts. Actual construction and procurement of all equipment are let to a variety of contractors and manufacturers on the basis of competitive bidding, the number of individual contracts being rather large. Allocation generally is to the low bidder, although this is not a binding policy.

The project as a whole

Beginning at the Valle di Lei Reservoir, the project extends downstream in the form of three separate power plants, all very similar in general arrangement (Fig. 1). From the water intakes, practically horizontal and completely concrete lined, pressure tunnels several miles in length lead to the surge tanks. These consist of a lower chamber below the minimum operating water level and an upper chamber above the highest storage level—the two connected by a vertical shaft.

The chambers are designed to allow for total plant shutdown from full load

Aggregates for Valle di Lei Dam, procured from quarry at upper left, are processed, completely dry, in plant on steep slope, above right abutment. Cement silos and concrete mixing plant, center foreground, have output of 230 cu yd per hour. Photo by G. Chiolini, Pavia.



Base and right abutment of Valle di Lei Dam, a double-curvature arch, get concrete from cableways and derricks with 260-ft booms. Photos by G. Chiolini, Pavia.

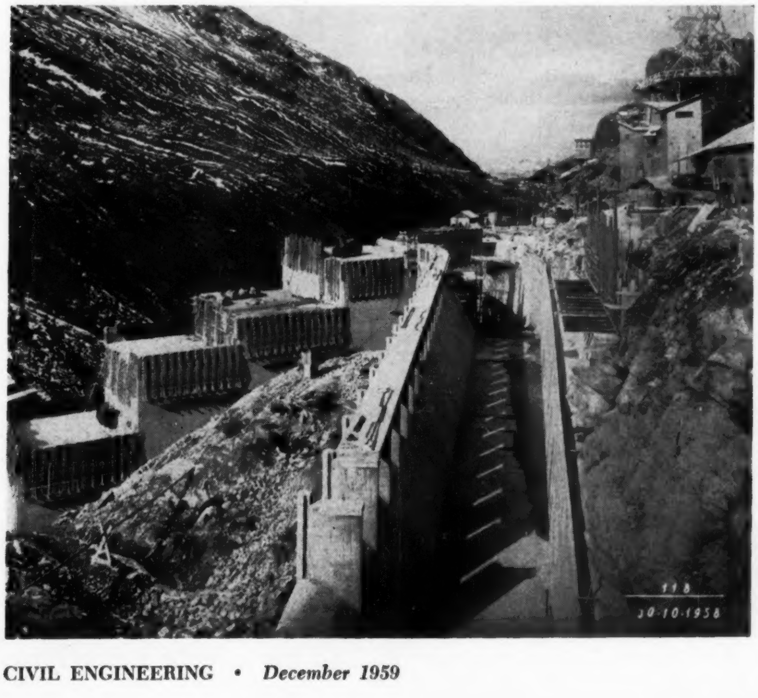
within 30 seconds, and complete reloading at the most critical moment, that is, when the oscillation of the water level due to the shutdown reaches its lowest point. It is obvious that such extremely rigorous operating conditions require large chamber volumes, but they are consistent with the flexibility considered essential. Incidentally all the hydraulic computatons necessary for this design work were performed on an IBM 650 electronic computer.

From the surge chambers, relatively short but steep pressure shafts, steel lined for their full length, carry the flow to the manifolds and thence to the spherical valves and turbines. All turbines are of the Francis type, operating under gross heads of up to 1,700 ft.

Ferrera Power Plant

The uppermost part of the project consists of the Valle di Lei Reservoir and the Ferrera underground powerhouse 4.3 miles downstream from it, along the pressure tunnel. See Fig. 2. The maximum gross head is about

Side-channel spillway (foreground), in right abutment of Valle di Lei Dam, will be capable of discharging 4,700 cfs. Photo by Chiolini, Pavia.



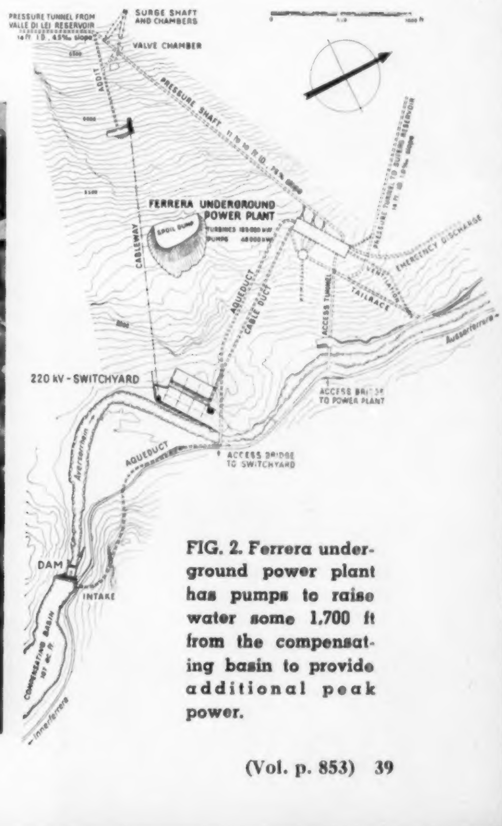


FIG. 2. Ferrera underground power plant has pumps to raise water some 1,700 ft from the compensating basin to provide additional peak power.

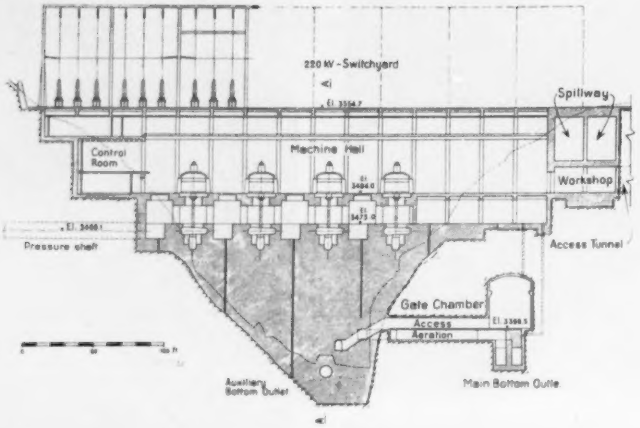
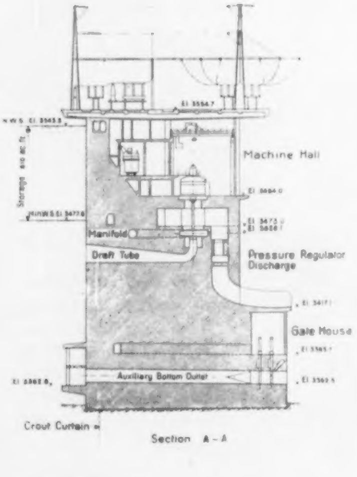


FIG. 3. Barenburg Power Plant, seen in longitudinal section, has four vertical-axis Francis turbines which operate at 1,000-ft head to produce 75,000 hp each. The powerhouse sits atop a gravity dam 200 ft high, which impounds water for the Sils Power Plant downstream.

1,700 ft, and the design flow 1,600 cfs. Each of the three horizontal-axis Francis turbines has a rated capacity of 83,000 hp.

Valle di Lei Dam is a double-curvature arch dam of the variable-center type. The arches are parabolic in plan and of uniform thickness. The maximum height above the foundation is 450 ft, and the total volume of concrete, 1.1 million cu yd. The design was described in more detail by its originator, C. Marcello, F. ASCE, in the ASCE *Proceedings* (vol. 82, 1959, Paper No. 994). In addition to a complete trial-load analysis on electronic computers, its structural behavior was checked on two concrete models at the scale of 1 to 66. These tests were not restricted to water-load and deadweight effects as usual, but included determination of the deflections due to annual temperature variations. To this end, both faces of the model were covered with electric warming pads. It is hoped that these special tests will permit a separation of static and thermal effects in future deflection measurements on the prototype.

FIG. 4. At Barenburg Power Plant, water from the turbines flows back through the dam (in the draft tubes) and into the upstream reservoir. Actually the reservoir is fed by a water source 3.3 miles away and 1,000 ft up.



Maximum storage at Valle di Lei Reservoir is 160,000 acre-ft. Since the natural watershed is far too small to fill it even once a year, additional water is brought in from adjacent valleys to the east through a free-flow tunnel 6.3 miles long. Seven creeks and rivers are intercepted, the intakes being designed for flows of up to 2.5 times the average summer runoff, the smaller ones of the bottom intake type with inclined rakes. Another intake discharges directly into the Valle di Lei–Ferrera pressure tunnel.

In addition, two 28,000-hp pumps installed in the Ferrera underground powerhouse can force a maximum of 280 cfs up through the pressure tunnel into the Valle di Lei Reservoir. The pumping water is upplied from a small compensating basin not far upstream from the powerhouse, where the runoff from the drainage area below the collector tunnel is accumulated. Water can also be pumped into this basin from tailrace of the powerplant, which in turn is connected with the Sufers Reservoir on the Hinterrhein.

The whole constitutes a rather bewildering system of conduits, pumps and basins laid out for maximum flexibility in operation. It finds its justification in the ability to transform cheap night and weekend energy into valuable peak-load power by means of pumped storage. The considerable losses of energy involved are more than offset by the variation in the price of electricity, in itself always the same product, according to its disposability. It is evident that these aspects of high-head storage plants will gain in importance with the advent of nuclear power, which has to be produced continuously and therefore is not readily adaptable to actual load requirements.

Barenburg Power Plant

The second part of the project begins at the 15,000 acre-ft compensating reservoir of Sufers on the Hinterrhein. This reservoir stores not only the river flow but also the discharge from the Ferrera Power Plant, with which it is connected through a tunnel 3.4 miles long. The reservoir is impounded by a slender arch dam with a maximum height of 200 ft and a volume of 25,000 cu yd of concrete, in a narrow gorge of the Hinterrhein. The powerhouse is near the other end of this canyon and close to the ruins of a medieval castle called Barenburg. The pressure tunnel running behind the left valley side is 2.1 miles long and designed for a flow of 2,800 cfs. The maximum gross head on the plant is about 1,000 ft, and the capacity of the four vertical-axis Francis turbines is 75,000 hp each.

This plant also utilizes the runoff from several secondary creeks. A collecting tunnel 3.3 miles long discharges directly into the vertical shaft of the surge tank. The flow is introduced at the top the shaft through an overflow channel spiraling around it, thus providing even distribution and minimum air entrainement in the water, which falls about 100 ft.

The Barenburg Powerhouse (Fig. 3) represents a rather unusual design in that it is built on the 200-ft-high gravity dam that impounds the small compensating basin ahead of the third power plant, Barenburg-Sils. The manifold is buried in the mass concrete, while the turbines and the machine hall sit on the sloping downstream face of the dam. This plan results in the somewhat paradoxical arrangement (Fig. 4), whereby water flows back through the dam, that is through the draft tubes and into the reservoir. Furthermore the roof of the powerhouse carries the switchyard, and the spillway channel passes immediately to the right of the building. The whole arrangement is extremely compact, but requires the utmost in coordination from both the design staff and the construction force.

The spillway, controlled by two flap gates, discharges over a ski-jump bucket back into the river gorge downstream from the dam. Utilizing both the bottom outlet through the dam and the adapted diversion tunnel, one-thousand-year floods up to 40,000 cfs can be discharged without raising the pool level more than 3 ft. This represents a runoff of 200 cfs per sq mile of drainage area and reflects the high flood hazard in this part of the Alps.

Barenburg-Sils Plant

Exactly where the second development ends the third starts—at the compensating basin formed by the dam described above. The pressure tunnel is 8 miles long and leads to the Sils powerhouse (Fig. 1) on the Albula River near its junction with the Hinterrhein. The design flow is 2,600 cfs and the maximum gross head about 1,400 ft. The powerhouse is of conventional outdoor design equipped with four vertical-axis Francis turbines of 77,000-hp capacity each. To provide the maximum available head, the Albula River is diverted into a deeper and shorter bed downstream from the tailrace mouth.

Across the river are located the large 220- and 380-kv switchyards, which collect not only the total production of the Hinterrhein project but also that of several other large projects in the area. Thence the energy is transmitted to the northwest and fed into the Swiss national power grid.

Construction progress

Construction of the Barenburg-Sils plant started in the spring of 1957; that of the first and second plants followed at one-year intervals. The completion dates are staggered accordingly and the last unit of the Sufers-Barenburg plant is scheduled to go on the line in the late summer of 1963. This gives a total of seven construction years. Each winter, from about December to April, all work comes practically to a standstill because of climatic conditions. This applies especially to the Valle di Lei dam site, which is about 6,500 ft above sea level.

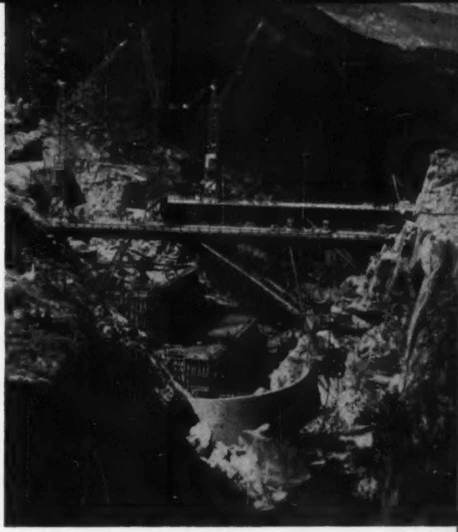
The underground structures are an exception, and work on them goes on the year round, although access to some of the addits is difficult in winter and exposed to avalanches. Some construction sites can be reached only by cableways or footpaths. The tunneling program determines the general construction schedule, and tunneling progress depends primarily on advancement rates during the excavation period, which in turn is determined by the nature of the rock formations encountered. Of the total of over 35 miles of tunnels of various sorts, roughly 40 percent are estimated to be through granitic gneiss and 60 percent through various kinds of shists. Problematic are some stretches, fortunately short, through Triassic rocks, which tend to crumble easily and may carry considerable water. With the exception of these sections, the full profile is generally excavated at once. Such rock support as may prove necessary is secured by anchor bolts or steel arches placed at intervals of about 3 ft. These supports are lost in the final concrete lining.

So far excavation of the Barenburg-Sils pressure tunnel has been completed, with an overall average advance of 16 to 23 ft per working day at each heading, of which there are a total of five at three addits and the lower end. Excavation on all the other tunnels is well under way.

At the Valle di Lei and Barenburg dam sites the construction plants have been erected and foundation excavation completed. Concrete placing in the Valle di Lei Dam started in the fall of 1958 and is scheduled to continue through two more working seasons. Aggregates are being quarried from a calcareous rock strata above the right abutment and processed completely dry. The cement employed, which contains puzzolanic earth, is transported from Italy by train, truck and a cableway over the mountains. Concrete is placed by three radial traveling cableways and one fixed cableway, plus two derricks with 260-ft booms.

At Barenburg, concrete placement started in the spring of 1959 utilizing ordinary tower cranes operating from temporary bridges upstream and downstream. Aggregates are procured from a central gravel pit serving all construction sites on Swiss territory. Likewise the cement is trucked from the nearest railway station to all job sites in large containers, which are emptied pneumatically.

Work on the powerhouses is also progressing on schedule. Excavation of the 450-ft-long cavern at Ferrera is nearing completion as is also the structural part of Sils, the first powerhouse to be placed in service. Altogether over 3,000 men are now employed at all the various construction sites. Progress so far achieved promises completion of the big undertaking on time and to the satisfaction of all connected with it.

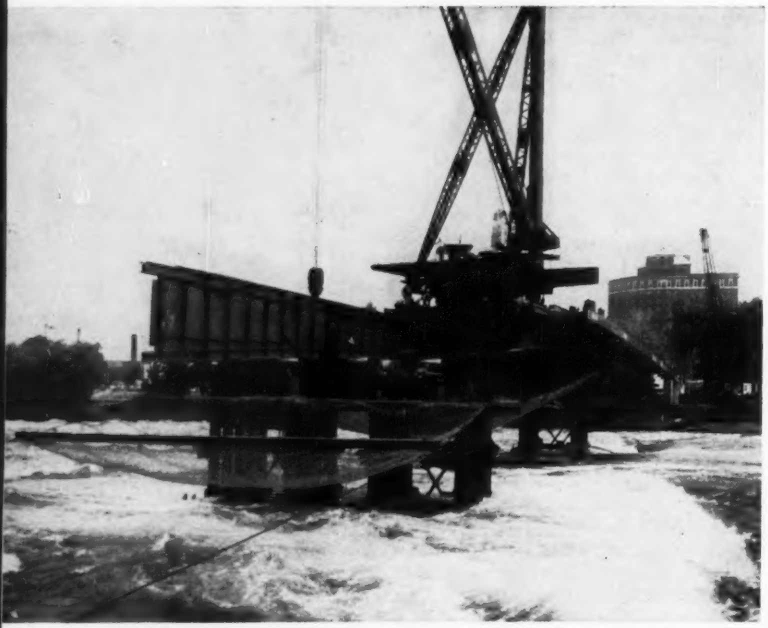


First blocks of Barenburg Dam are under construction behind thin-arch cofferdam in foreground. Concrete is placed by tower cranes on two temporary steel bridges. Crest of dam will be about at height of crane booms. Photo by H. Rostetter, Ilanz.

Barenburg-Sils pressure tunnel is drilled to theoretical diameter of 19 ft. Photo by C. Guler, Thusis.

For lining of Barenburg-Sils pressure tunnel, telescopic steel form is used. Floor will be concreted in a separate operation. Photo by C. Guler, Thusis.

LONGEST PLATE-GIRDER



A section of girder is being swung into place. Temporary bents were anchored by driving 14 WF piles with reinforced points as far into bedrock as possible, but on some bents this anchorage was reinforced by cables from shore.

E. H. PRAEGER, F. ASCE

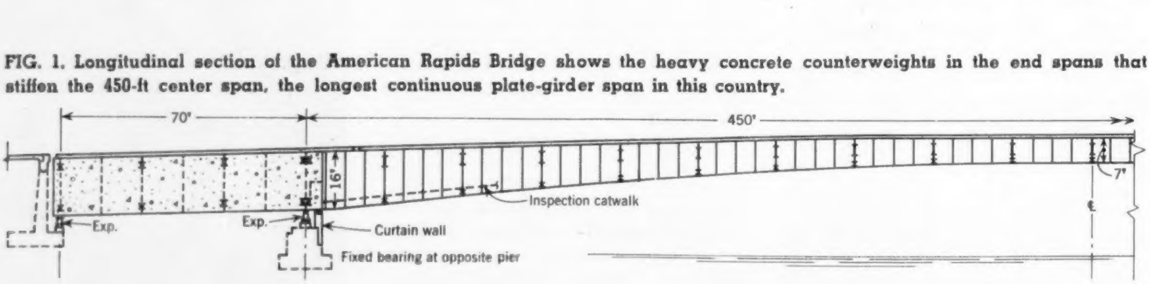
T. C. KAVANAGH, F. ASCE

Praeger-Kavanagh, Engineers, New York, N. Y.

The rapids of the Niagara River, between the falls and Goat Island, are now spanned by a bridge that was completed on November 30. The American Rapids Bridge, with a main span of 450 ft, crosses the turbulent rapids 2,000 ft upstream from the U.S. part of Niagara Falls. It connects the new parkway system with improved tourist facilities on Goat Island and provides access for construction operations on the island.

A low-level plate-girder bridge harmonizes best with the landscape features. The three-span continuous structure has spans of 70, 450 and 70 ft. The main span consists of haunched plate-girders varying in depth from 16 ft at the supports to 7 ft at mid-span. The short end-spans are heavily counterweighted with concrete to form rigid composite beams providing fixity

FIG. 1. Longitudinal section of the American Rapids Bridge shows the heavy concrete counterweights in the end spans that stiffen the 450-ft center span, the longest continuous plate-girder span in this country.



SPAN IN U.S. COMPLETED

for the center span. The center span is the longest in this country, but the depths are relatively shallow, the center depth being 1/64th of the span. The counterweighed spans are enclosed by stone masonry walls.

Several advantages were achieved by providing continuity: (1) the structure can "breathe" freely and expand and contract in length with temperature; and (2) adjustments and movements at the supports could easily be made to accommodate closure, weighing, and other erection operations.

There are two 12-ft traffic lanes designed for an H20-S16-44 truck loading, with a cantilevered sidewalk on each side. The sidewalks are depressed below the roadway and thus the handrails do not obstruct the view of those crossing the bridge in automobiles.

Three main riveted girders are spaced 11 ft on centers. They are of medium manganese steel throughout, meeting the physical requirements of ASTM specifications for A 242 high-strength low-alloy steel. Each flange has four 8 x 8 angles with side plates and cover plates. Top bracing is provided throughout, and there is bottom bracing from the support to the fifth panel point. The necessary torsional strength to support the cantilever sidewalks is provided by frames 22 ft 6 in. on centers, in the deeper end portions of the span, and by knee-braced diaphragms in the center section. High-strength rivets were used for main-girder splices and high-strength bolts on other field connections.

On the main span there is a 7-in. slab of lightweight concrete (3,750 psi) with 1-in. asphalt plank surfacing. The sidewalk consists of 4-in. lightweight concrete slabs. Handrails, roadway rails and light standards are of aluminum alloy.

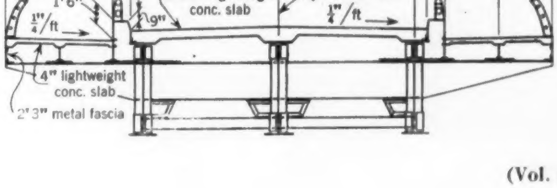
The approach over the new Niagara Parkway, leading to a ramp down to Buffalo Avenue, consists of two 60-ft composite steel stringer spans, and that over the new Goat Island Drive on the island is a 76-ft stringer span. The necessity of keeping the deck low, to avoid excessive grades from Buffalo Avenue, was a factor in the selection of the counterweight spans, as longer side spans would not have permitted sufficient underclearance on the parkways.

The structure is founded on bedrock, which is close to the surface. Stone masonry protects the piers at the river's edge against scour and ice.

Maximum use of digital computer equipment expedited the design. Many alternates were studied, including prestressed concrete truss and girder spans, prestressed steel spans, orthotropic plate-girder boxes and tied arches. The 450-ft span was planned so that it could be erected either by cantilevering from both sides of the river or by the use of falsework bents from the mainland side only. Bethlehem Steel Company, the superstructure contractor, employed the latter procedure. The temporary bents were anchored primarily by driving 14 WF piles with reinforced points as far into rock as possible, but on some bents this anchorage was supplemented by cables from the shore.

The bridge was built under the jurisdiction of the Power Authority of the State of New York, as part of the park and parkway program being constructed incidental to the $720,000,000 Niagara Power Project. Hon. Robert Moses is Chairman of the Authority, Col. William S. Chapin is General Manager and Chief Engineer, and William H. Latham, M. ASCE, is Resident Engineer. Contractor for the substructure was the W. S. Johnston Building Company, Inc. G. B. Shaw, Jr., F. ASCE, acted as Manager of Erection for the Bethlehem Steel Company. Design and supervision of construction were by Praeger-Kavanagh, Engineers, of New York, for whom Robert Young, M. ASCE, was Project Engineer, with Ira Hoyt and Arthur J. Bishop, Resident Engineers.

FIG. 2. Cross section at midspan shows two-lane plate-girder structure with depressed sidewalks.



CONCRETE PRODUCTION

a prime factor in paving of the Dulles International Airport

WILLIAM E. GABLE, M. ASCE, Project Engineer, C. J. Langenfelder & Son, Baltimore, Md.

Nearly half a million cubic yards of concrete are going into the Dulles International Airport to pave three runways, the accessory taxiways and high-speed turnouts. Concrete is batched, mixed and handled from a central plant that is extraordinary for paving work, being equipped with three 10-cu yd mixers. All other equipment is on the same scale. A record 5,435 cu yd was recently placed on a single shift.

The airport, 27 miles west of Washington, D. C., at Chantilly, Va., is being built by the Federal Aviation Agency under the direction of Herbert H. Howell, F. ASCE. It will have parallel north-south runways 11,500 ft long and a northwest-southeast runway 10,000 ft long, centered on a terminal area. See Fig. 1. The runways have a width of 150 ft and the taxiways a width of 75 ft paved with portland cement concrete, each with asphaltic concrete shoulders 25 ft wide. In critical areas, such as the ends of runways and taxiways, the concrete is 15 in. thick on 9 in. of crushed-aggregate base course. In non-critical areas the concrete is 12 in. thick on the 9-in. base course.

Production and placing of 481,000 cu yd of concrete before August of 1960 is the prime factor in the $12,500,000 contract awarded to C. J. Langenfelder & Son of Baltimore, Md., in December 1959. Actually, concreting of the two north-south runways and adjacent taxiways (except for the connections between them) was completed in mid-October. The asphaltic shoulders will be placed next season, as will the remaining concrete for the third runway.

The central mixing plant is the hub of the operation, feeding material in record amounts to a paving train that is able to place and finish more than 500 cu yd of concrete an hour. The plant is located at the center of haul of all areas to be paved, to keep the total hauling distance to a minimum. Also, it is centrally located for incoming materials. See Fig. 2.

A newly opened quarry three miles southwest of the batching plant supplies base-course material and aggregates. Each day some 6,000 cu yd of mixed stone is moved over new haul roads directly to the runways for use in the base course. Another 5,500 tons, in two carefully graded sizes, is transported to the batch plant for use as coarse aggregate. Sand comes by rail to a temporary siding on the Washington & Old Dominion Railroad, six miles to the north, where provision is made to unload 3,000 tons of sand daily from hopper cars directly into transport trucks. From the south, tanker trucks of 100-bbl capacity bring in cement to keep the plant's storage silos supplied.

Aggregates, sand, and two sizes of crushed stone are hauled in about as needed and dumped through separate 100-ton hoppers, which feed directly to one of three 30-in. belt conveyors. An auxiliary stockpile of each material is located near its respective hopper, with recovery handled by front-end

FIG. 1. The batch and mixer plant is located centrally in the area to provide minimum length of haul.

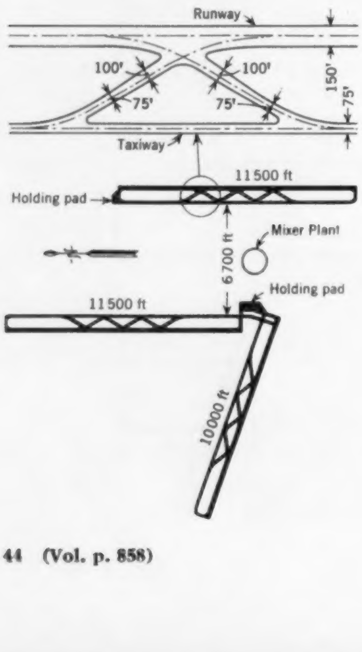
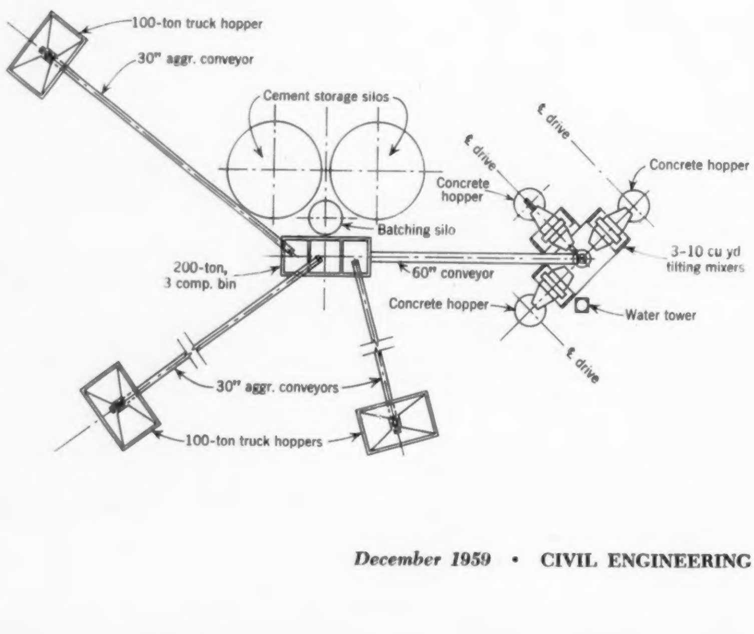


FIG. 2. Conveyors carry hauled-in aggregates to top of three-compartment bin over weighing batchers. Here aggregates are combined with cement for delivery to any one of the three 10-cu yd tilting mixers.



loaders. The belts converge for delivery to a bin of 200-ton capacity located over the weighing batchers. Two 7,500-bbl cement silos provide the major storage. A vertical-feed screw transfers cement from the storage silos to a 600-bbl double-cone batching silo.

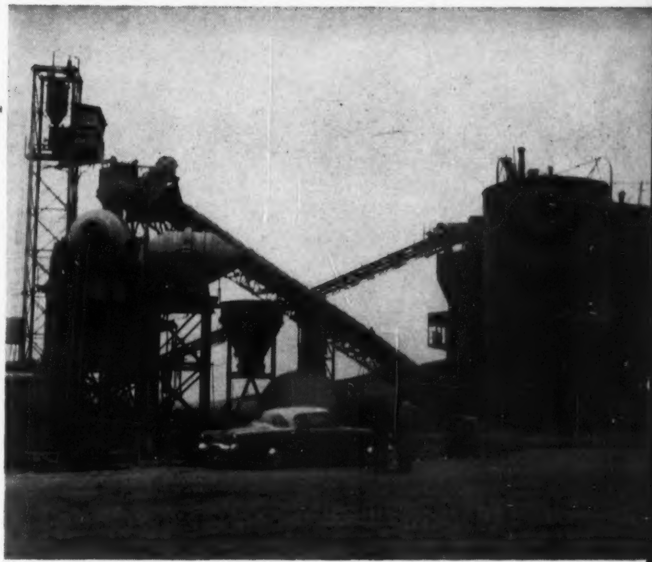
The coarse and fine aggregates, along with the cement, are automatically and simultaneously weighed through the batchers to insure exact proportioning. Over-and-under dials give a visual check on the proportioning.

Aggregates and cement are blended together as the hoppers are dumped into a 10-cu yd receiving hopper, which feeds to a 60-in. belt for delivery to the mixers. The belt conveyor is covered to protect the cement from wind and rain. It transfers the dry mix to a swivel distributor atop the three mixers, which are charged independently. Water comes from two deep drilled wells in the immediate area and is pumped into 20,000-gal ground storage tanks, from which the required amount for a batch is fed to a smaller tank at the top of a tower adjacent to the mixers.

Water is fed into the mixer drum as the belt feeds the 10 cu yd of material for a batch. The 10-cu yd T. L. Smith mixers rotate horizontally for mixing, then tilt 45 deg to discharge the concrete into individual 20-cu yd holding hoppers.

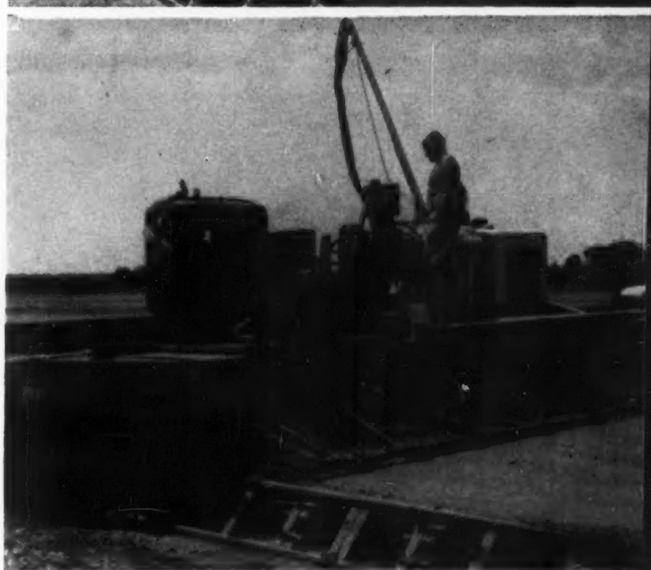
Complex as it seems, the fully automatic cement and aggregate batching and mixing plant is essential for high-capacity paving operations. This plant, which was supplied by the Noble Company, is portable to some degree, but is suitable primarily for larger jobs, since a considerable expense is involved in providing adequate foundations and in erecting the 344 tons of steel in the plant.

A fleet of 25 White trucks with open 6-cu yd Maxon Dumpcrete bodies haul the mix to the paving train at an average rate of three trucks every two minutes. Heading the paving train are two Maxon Dumpcrete spreaders, capable of placing concrete across the 25-ft lane width specified in the contract. The concrete, of $1\frac{1}{2}$-in. slump,

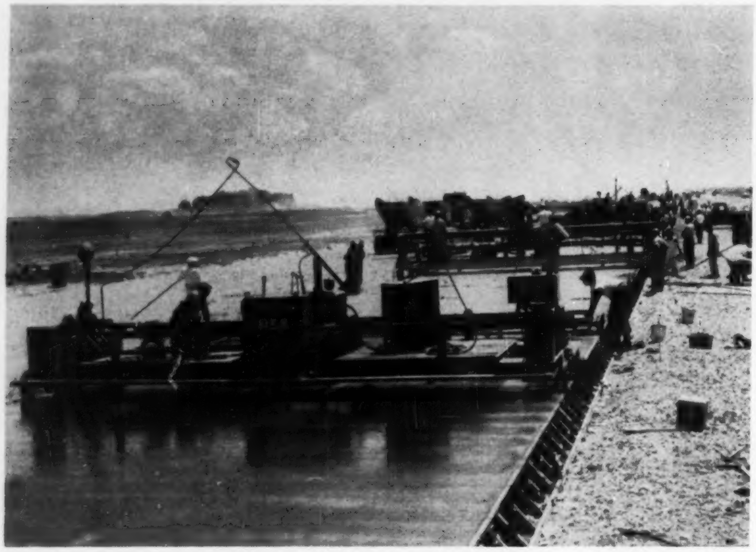


Mixers dump into 20-cu yd hoppers for transfer to Dumpcrete trucks at central plant of C. J. Langenfelder & Son, Inc. In background are cement silos and aggregate bins.

Dumpcrete delivers concrete to Maxon spreader for transfer to the subgrade.



Vibrating screed compacts low-slump concrete ahead of the finishers.



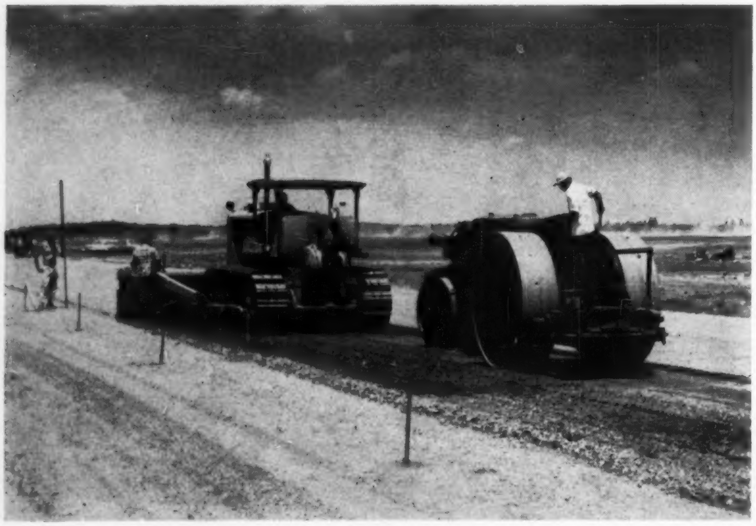
Paving train is seen from the rear. Caboose carries equipment for applying curing compound; next comes a float bridge, and third, the machine for installing joints.

is dumped from the transport trucks to the spreader boxes and placed in approximately equal lifts by the two spreaders.

Immediately behind the train leaders, two Jaeger double-screed transverse finishing machines vibrate and screed off the concrete to the required elevation. These quick-adjusting screeds are capable of finishing concrete to any desired template, whether it be the parabolic curve on the center lanes or the simple straight lines used on the exterior lanes.

A Lewis finishing machine with a trailing V-float gives the final machine finish. Next in line, a vibratory joint machine inserts the Form Con plastic joint strips which form the contraction joint every 20 to 25 ft in both runways and taxiways. And no paving train is ever complete without the hand finishers that check the surface to ensure that the required tolerance is met—here 1/8 in. in 10 ft—and to provide the final texture by rolling a hose along the surface, followed by a burlap drag. The "caboose" in the train, a Rex machine, sprays a clear Permite membrane compound on the surface to ensure correct curing of the pavement slab.

Base for runway is spread by box on dozer blade of tractor, then compacted with a vibrating roller on the three-wheel unit shown.



Of special interest are the plastic joint strips used in forming the contraction joints. These strips, 25 ft long, V-shaped and about 3 in. wide, are gripped every 6 in. along a vibrating bar by steel jaws to ensure a straight joint and are vibrated into the low-slump concrete in a matter of seconds. These reusable plastic strips, developed by American Sisalkraft Corp., remain in the pavement slab for the duration of the curing period to ensure proper strength of the concrete at the joint. Since the strip is placed before the membrane curing compound is applied, it prevents any interference with the adhesion of joint-seal materials. This eliminates any possible need for the wire-brushing of joints before the sealer is applied.

Working about three days ahead of the paving train, the fine-grading crews shape and prepare the subgrade to within the specified 1/2 in. of the theoretical cross-section. Stone spreaders and trucks place the 9-in. compacted depth of crushed base-course material in two equal lifts. To meet the requirement of 98 percent of maximum density for the base-course material, this material is rolled by an Essick vibrating roller in conjunction with a 10-ton roller.

The form crew, preceding the paving train by about a day, set the 12- to 15-in. forms correctly to grade. A mechanical tamper compacts fine stone under the forms to prevent settlement as the heavy equipment passes over them. The final grade, prior to concrete, is achieved by placing an average of 1 1/2 in. of stone dust, then rolling and compacting it to within the specified limits. A multiple-pin templet drawn along the form constitutes the final check to insure the proper contour and depth of concrete specified.

Area grading at the airport is also being done by Langenfelder. In fact, the company has contracts totaling more than $19 million at the site. These contracts are under the direction of William Hazelhurst. B. G. Woolfolk is general superintendent, with R. C. Mathern in charge of paving and Orville Carver running the concrete plant. The writer is project engineer.

For the Federal Aviation Agency, Ammann and Whitney did the runway design. Field supervision of construction is under R. S. Ransome, resident engineer.

Radial gates find new use

RICHARD N. WHITE, A.M. ASCE, *Structural Engineer*

John A. Strand, Consulting Engineer, Madison, Wis.

A unique locking system that gives improved operation at substantial savings in cost was adopted for the new lock and dam recently completed in Madison, Wis. The system uses Tainter (radial) gates for the lock. Since the lock can be filled and emptied by flow under these gates when they are in the partially open position, all ordinary valving and discharge ports and openings are eliminated. The boat traffic, consisting primarily of small pleasure craft, passes under the fully open gates, as shown in an accompanying photograph.

The Tainter gate has been widely used for many years, in controlling lake and stream levels, in irrigation spillways, and for valving purposes in hydroelectric stations. Searches made in the University of Wisconsin Engineering Library and in the Engineering Societies Library in New York, plus inquiries to the Corps of Engineers, have revealed no references to the use of overhead-opening Tainter gates in locks in the United States, although similar installations have been constructed in Europe.

When the use of this economical and simple gate for locking purposes was first considered, an inherent disadvantage soon became evident—the short radius of the gate limits the overhead clearance for lock traffic. In some previous installations, this difficulty was overcome by completely submerging the gate and allowing the traffic to pass over it. However this system involves the costly construction of underwater gate chambers, and this was not considered for the Madison locks.

The locks are at the outlet of Lake Mendota, which drains into the Yahara River, a rather narrow and shallow stream crossed by eleven street and railway bridges having a minimum clearance of less than 8 ft above normal water level. Since the lock gates have a clearance of over 8 ft when fully open, they will provide ample headroom considering the limitations imposed by the low bridges downstream.

The main factor in the final selection of Tainter gates instead of the more conventional miter gates was the improved operating qualities they provide. All preliminary calculations on different emptying and filling systems for the lock, which is 80 ft long by 20 ft wide, were based on a desired filling or emptying time of one minute for a normal water differential of 4.3 ft. The old lock at this site, which was much smaller than the new one, had hand-operated gates and a five-minute filling time. The desired one-minute filling time thus placed rather strict demands on the filling system.

The conventional miter-gate system was first studied. To avoid the use of costly side or bottom ports for filling the lock, it was proposed to fill it through a butterfly valve of 60-in. diameter discharging into a curved entrance under the upstream gate sill. Emptying would have been through a similar valve, discharging into a downstream boat basin.

The lock, owned by the city of Madison and located in a city park, carries a traffic consisting mainly of small fishing boats and pleasure craft, with an occasional canoe. Therefore minimum turbulence was imperative, both in the lock and in the boat basin. The hydraulic characteristics of a slower butterfly-valve system might have been satisfactory, because of the available water cushion and curved entrance, but at the desired speed such a valve certainly would have caused too much turbulence.

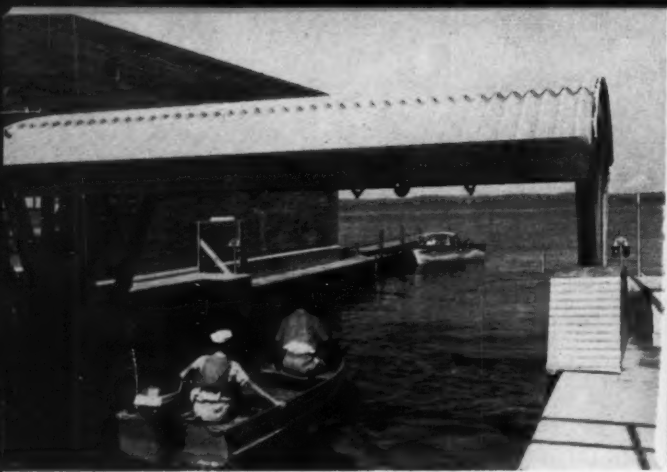
With the Tainter gate system, the lock is filled and emptied by flow under the gates. Assuming a coefficient of discharge of 0.80, the hydraulic calculations showed that 65 sec would be required to equalize the water levels if the gate were raised 1.6 ft off the lock bottom at a uniform rate. (A coefficient of discharge of about 0.70 would be more realistic, according to the ASCE Hydraulics Division Paper No. 1935, "Problems Concerning Use of Low-Head Radial Gates," by Thomas J. Rhone, February 1959.) For this slow opening rate, the rate of change of discharge is small, which is the most important factor in reducing turbulence. Thus a large discharge rate is possible, since the transition to heavy flow is gradual. At the end of the flow period, with the water levels equal on both sides of the gate, a high-speed drive automatically lifts the gate to its fully open position.

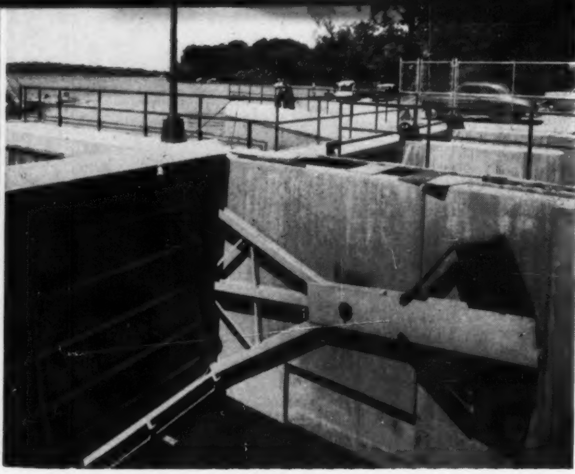
The high horizontal flow velocities are confined mainly to the bottom of the lock, since the water flows under the partially open gate. At the peak flow of 175 cfs, this opening is about one foot high and 20 ft wide. At the upstream gate, the flow is directed to the lock bottom by a baffle plate. See Fig. 1. Thus boats are protected from horizontal currents by a substantial water cushion in which the water movement is mainly upward.

Actual slow-speed opening time is about 90 sec with no objectionable turbulence. This combined speed and smoothness of operation would have been impossible with a miter-gate system employing a single filling valve and entrance.

As on most construction projects, initial cost played an important role in the selection of the locking system. Conservative cost comparisons revealed an approximate initial saving of $25,000 secured by using Tainter gates instead of miter gates. Savings were largely due to the elimination of butterfly valves and their operating equipment, and of the costly intake and discharge facilities for these valves. Savings in construction and inspection time and in site unwatering costs were also substantial. The area was diked off and the river flow bypassed through a flume.

The Tainter gates themselves were





At left, a pleasure boat passes under Tainter gate of lock while it is in the fully open position. This boat is typical of the traffic handled by the lock. Fully opened gates have clearance of over 8 ft. Shown at right, counterweighted tainter gate is 21 ft wide and about 14 ft high. Members of the horizontal face are heavy 12-in. channels, faced with 12-gage corrugated steel multi-plate, curved to a 12-ft radius. Arms are 6WF20 members with angle bracing.

slightly more expensive than miter gates, and drive equipment for the two systems was comparable in price. The Tainter gate system has a definite advantage from the standpoint of maintenance, since there are no valves or valve equipment to keep in operating condition. Maintenance on the gates proper would be about the same for both systems.

The gates are similar in design to the standard Tainter gates used on spillways. Both of the lock gates are 21 ft wide, about 14 ft high, and have a face-plate radius of 12 ft. Steel channels 12 in. deep are used for the horizontal members, with 6-in. wide-flange arms to carry the water thrust back to the pivot point. The face-plate is deeply corrugated metal of 12 gage, similar to that used in heavy arch culverts. Short stub shafts are mounted on each side of the gate and pivot in heavy, rigid pillow-block bearings. All connections are welded.

Small sheet-metal troughs along both edges of each gate, and sloping from the center to the sides, were welded to the channels. Their function is to carry dripping water to the sides of the gate.

Cast-iron counterweights reduce the torque necessary for gate opening. The net downward force on the gate sill is 500 lb when the gate is in the closed position. This assists in maintaining a tight seal around the gate. The counterweights are covered with galvanized metal covers to prevent interference with boat traffic.

On the sides and bottom of the gate there are rubber seals with a hollow-bulb, J-shaped section—sometimes called the music-note or pork-chop seal. See Fig. 2. The side seals rub against a polished aluminum structural angle set in the concrete lock wall and curved to match the radius of the gate. Both the rubbing angle and the seal are set at a slight vertical angle in relation to the edge of the gate, causing the seal to pull away from the lock wall as the gate is raised. This seal detail eliminates most of the heavy friction wear on the seal. Seal continuity around the gate is provided by using molded rubber corners where the side and bottom seals come together, and a nearly drop-tight seal is achieved.

Gate-drive equipment

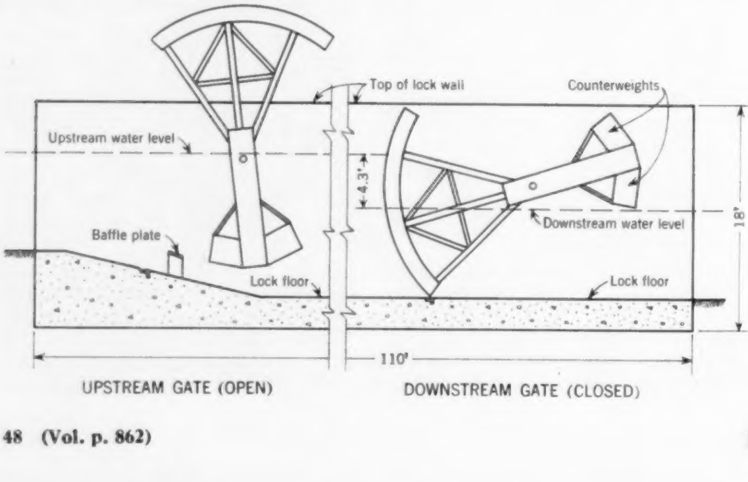
Since the heart of the entire lock system is the gate operating mechanism, many alternate types of drive were considered. Because boat traffic precludes the use of a pivot shaft extending across the lock, the gate must be driven from both sides. But a drive system with separate drives on each side presented the difficult problem of synchronization, a problem also encountered on lift bridges.

To solve this problem a hydraulic system was chosen after bids had been received on the project. Driving pistons are mounted on each side of each gate, actuated by a centrally located, electrically driven hydraulic pump operating at 1,500 psi for the high-speed drive, and a similar, but much smaller hydraulic pump for the inner opening cycle. The large pump has ten pistons, with five pistons operating on each side of the gate—three for the raising cycle and two for the lowering cycle.

By pumping equal volumes of oil to each side, the sides of the gate are kept in phase with each other and twisting is prevented. Maximum opening torque required is about 30,000 ft-lb. One pumping system provides the driving power for both gates, and welded steel tubing supplies the high-pressure oil to the pistons. The hydraulic flow is automatically switched from one gate to the other by four-way valves, electrically operated.

The hydraulic pistons are mounted in a fixed position in recesses in the lock wall, as shown in Fig. 3. Segmen-

FIG. 1. In section through lock, upstream gate is in the open position and downstream gate in the closed position.



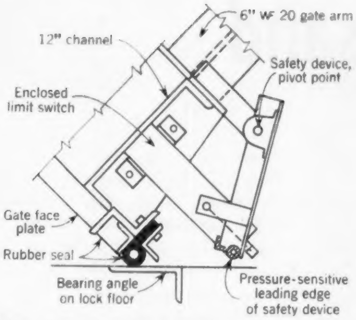


FIG. 2. Gate has a bottom seal and a safety device to protect boats from being struck when it closes. A slight pressure on the aluminum member that extends completely across each edge of the gate, activates a covered limit switch that stops the gate at once.

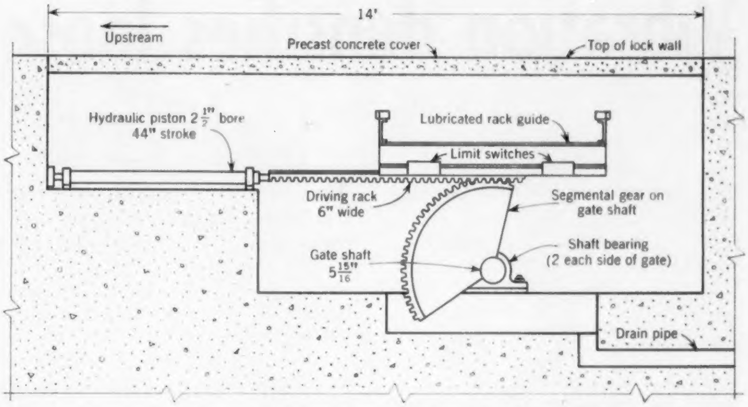


FIG. 3. A typical pit in the lock wall houses gate-drive equipment, here shown in section with the gate in the closed position. The position of the gate shaft is controlled by limit switches mounted on the rack guide and actuated by the driving rack.

tal gears of 2-ft radius, attached to the gate shaft, are driven by a rack extension on the piston rod. Use of a fixed guide for the moving rack prevents bending moments from developing in the piston rod.

Actual operation of the gates is accomplished through a system of push-button controls located in the control room at the edge of the lock, and operated by a full-time lock attendant. When the raise button is pushed, the gate rises slowly off its sill to a height of 1.6 ft in about 1½ min, at which time the water levels are equalized. The gate is then driven to the open position by the large hydraulic pump in about 15 sec.

Operation of gates

Lowering the gate is accomplished in about 35 sec by the large hydraulic pump, which operates until the gate nears the bottom sill. Then the slow-speed pump takes over to gently drive the gate into its final closed position.

The gate is stopped in the open and closed position by limit switches mounted on the rack guide in the drive pits. These switches, which are actuated by cams on the moving rack, also control the change from the slow to the high-speed drive, and vice versa. These same limit switches provide an interlock between the gates which prevents the opening of both gates at the same time. This is an important function, of course, as it eliminates the possibility that the lake will be drained through the lock with both gates open.

An emergency stop control makes it possible to stop a gate in any position. This illustrates a natural advantage of a hydraulic system over an electric drive—the self-breaking action of a hydraulic piston. By closing the electrically operated valves in the hydraulic lines, the gate can be held in a fixed position indefinitely. In case a hydraulic line should rupture, valves at the pistons close automatically and keep the gate in the locked position.

Safety considerations

In a lock handling small boats exclusively, safety for boat occupants is of primary concern. Finding adequate and workable safety devices proved one of the most troublesome parts of the design. However, it is felt that the several safety features incorporated make the locks as safe as, or safer than, a comparable miter-gate lock.

The emergency stop button on the lock operator's control panel provides him with the power to stop the gate almost instantly and hold it in any position for any desired period of time. In case a boat should happen to get under a gate on its downward cycle, a pressure-actuated safety device has been installed on the leading edge of each gate. See Fig. 2. The device is built of aluminum and is connected to limit switches mounted at the bottom of the gate in inverted steel boxes, utilizing the bell-jar principle to keep water away from the switches. A slight pressure against the aluminum tube trips the switches (which are tied into the emergency stop circuit) and immediately stops the gate.

A safety feature was incorporated in the structural design by placing the gate counterweights in such a position that power is required to drive a gate down from the fully open position. A gate, when open, can be completely disconnected from the hydraulic piston and there will be no danger to the boats passing under it.

Further provisions for the protection of the boating public are area floodlighting, a system of green-red traffic lights on the lock wall, and a warning buzzer that rings when a gate is moving.

The Tainter gates do have several minor disadvantages that are difficult to evaluate. One is psychological—the natural human fear of passing under a heavy, mobile structure. This should not be a serious problem as soon as lock users realize that it is impossible for a gate to fall on them.

Another factor is the slight drip from the gate when it comes out of the water. The runoff troughs, mentioned in the gate description, were installed after the gates were in place and have eliminated all but a few drops. It is felt that this refinement will satisfy the boaters and there will be few if any complaints.

Appearance is important because of the location of the lock in a city park and the heavy boating traffic it carries. The miter-gate system, with nothing protruding above the lock walls, would present a neater appearance. However, this should be offset by the unusualness of the Tainter gates and interest in their operation.

Who did it

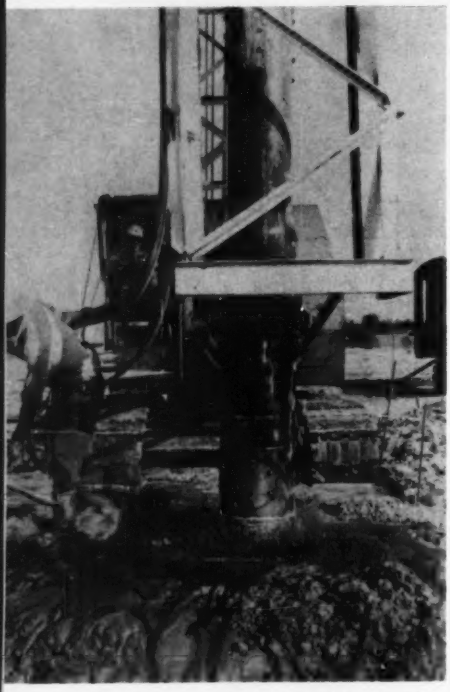
The C and C Construction Co., Inc., of Fort Wayne, Ind., was the general contractor for the entire project. Robert J. Nickles Electric Co. of Madison was the electrical contractor.

Engineering was done by the consulting firm of John A. Strand, Madison, working with the Madison City Engineer, John G. Thompson. Ivan A. Nestingen, Mayor of Madison, and the Madison City Council, were instrumental in giving the project its early impetus. Credit is due to Richard H. Jann, A.M. ASCE, of the Strand firm, for the initial idea of using Tainter gates for the locks.

Vibration densifies loose sand

JAMES OWEN POWER, M. ASCE

Dignum Associates, Miami, Fla.



Reversible water jets combined with a powerful eccentrically mounted motor effect compaction to a depth of 14 ft, working in an additional 2 to 3 cu yd of sand at each compaction point.

The new Bazaar International in Riviera Beach, Fla., rests on loose sands compacted by Vibroflotation. The building will house a group of specialty shops, stores and offices. The main building is a rectangle 280 ft wide by 601 ft long at the first-floor level with a partial second floor. Vibroflotation will also be utilized for adjacent structures.

Soil borings indicated a surface condition of loose, wind-deposited sand underlain by denser sands. Standard penetration tests gave values of from 2 to 12 blows per ft on the sampler in the first 12 ft. At a depth of about 12 ft, the number of blows recorded began to increase uniformly to a value varying between 30 and 40 blows at a depth of 25 ft. The site was level and the water table was from 8 to 10 ft below the surface. Sieve analyses of the loose surface sands indicated a uniformity coefficient of 1.4 and an effective size of 0.22 mm. Only 0.2 percent by weight passed the No. 200 sieve.

The main building is framed in reinforced concrete. The low roof and second floor are of poured concrete of rib-and-band construction. The high roof consists of a series of folded plates. Columns are spaced 20 ft on centers in both directions. A typical one-story column carries about 80 kips and a two-story column about 135 kips.

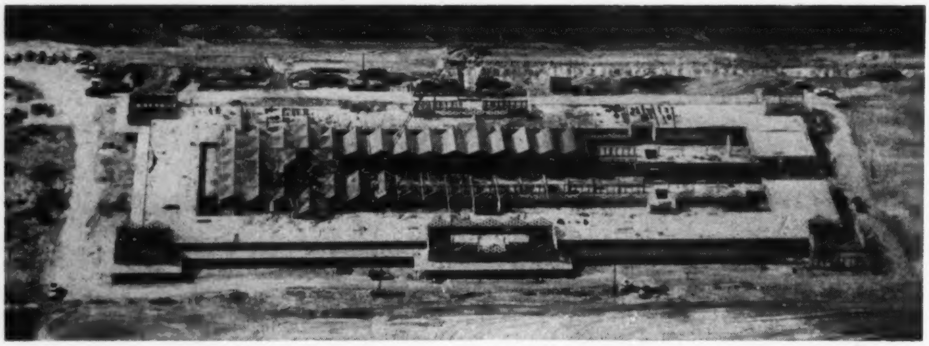
Specifications called for a compaction depth of 14 ft and a minimum relative density of 60 percent under all footings. A single compaction operation was adequate under lightly loaded columns; two were used under the more heavily loaded columns. The foundation was designed for an allowable bearing pressure of 4,000 psf. Walls of the first story are supported on grade beams which span between the column footings. The first-floor slab was poured on about a foot of fill compacted by rolling. This fill was placed before Vibroflotation.

The Vibroflotation contract for the main building amounted to $31,410, based on 590 compactions 14 ft deep. Using two Vibroflots, the work was completed in two weeks. From 2 to 3 cu yd of fill were added at each compaction location. This fill was not imported but was secured from the site.

An adjacent warehouse is 80 ft wide by 260 ft long. Roof framing consists of precast lightweight concrete roof planks on prestressed I-joists. These span 40 ft from a center concrete girder poured in place to exterior bearing walls of concrete block. About 133 compactions 14 ft deep will be required. For a laundry building of similar construction, 40 compactions will be used.

A concrete observation tower for the project has a height of 225 ft. It will be supported on 42 concrete-filled steel piles of 30-ton capacity. The decision to use piling was influenced by the very severe stability requirements imposed by the possibility of hurricane winds. The use of piling made it possible to concentrate the reactions at a considerable distance from the center of gravity.

The developer of the Bazaar International is Joseph Mass. Alfred Browning Parker of Miami is the architect. The engineering design was done by Dignum Associates, consulting engineers of Miami. Norman C. Schmid and Associates, engineers of Palm Beach, supervised construction. The general contractor is Butler and Oenbrink of Palm Beach.



Florida market place has been safely built on loose sand compacted by vibration.

Vertical crack in a high brick building (at upper left) is repaired by removing bricks along vertical cut made with abrasive saw, and rebuild-with new bricks. Men on lower scaffold are waterproofing the surface. In close-up, a brick along the saw cut is being removed.

LEAKAGE—

in masonry and curtain-wall construction

RAYMOND W. EHRENBERG, Vice President, Brisk Waterproofing Company, Inc., New York, N. Y.

There are two distinct types of leakage to be discussed—in masonry and in curtain walls—and each has its own peculiar problems. In thick-walled masonry buildings it takes the force of a heavy, driving rain to develop leakage. On the other hand, in curtain-wall structures, with walls perhaps 1½ in. thick, even a tiny opening may admit water.

Masonry structures

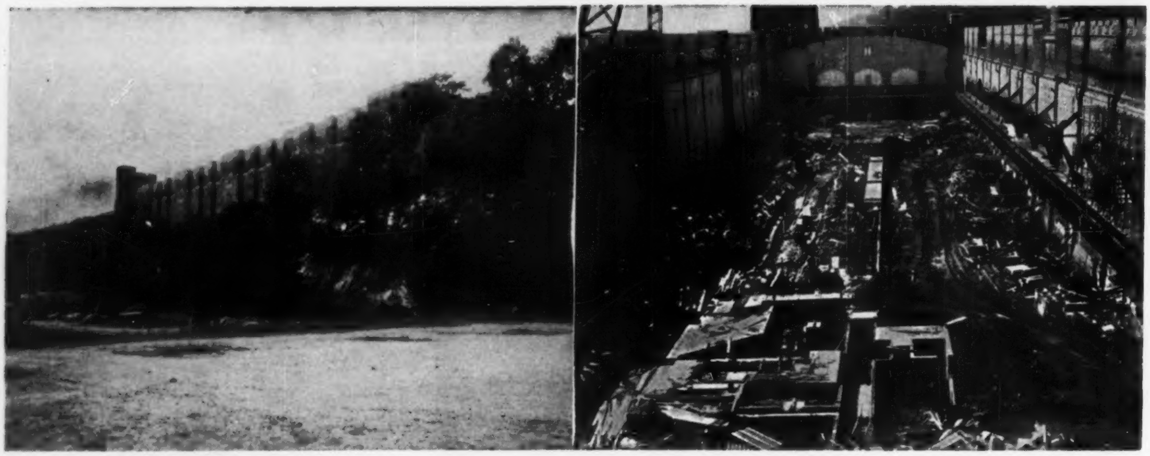
Today, with construction costs so high, a new and appreciative look is being given to America's fine old stone and brick buildings—churches, schools, public buildings and historic structures. More than ever before, attention is being directed toward their care and preservation. As a matter of fact, the problem of leakage is widespread among all sizes, shapes and ages of buildings. For example, a survey of 2,708 school buildings, made by the Builders Waterproofing Association, showed that 550 leaked badly.

Sources of leakage may be faulty flashings, open coping joints, or deteriorated calking. More often leakage is due to defective wall joints, that is, disintegration of the mortar. Shrinkage is characteristic of ordinary cement mortar, which thus becomes capable of absorbing and retaining quantities of water. Expansion of this water upon freezing causes the mortar to crack. The process repeats itself until the mortar disintegrates.

Once water has infiltrated masonry walls it acts as a most insidious agent of deterioration. Unseen and unchecked, it corrodes metal, disintegrates stone, destroys plaster, causes wood to decay. Leaks, if ignored, cause weakening of exterior walls; staining and deterioration of interior walls, ceilings and floors; rusting and corrosion of metal structural members; deterioration of wooden floor beams, joists, sills, and frames; breakdown of stone coping; increased heating and maintenance costs; and unhealthful dampness and cold.

In looking for the sources of water penetration into a building, the exposure should be noted, since leaks reflect the direction of wind-driven rain. Along the Atlantic seaboard, for example, the most serious storms are northeasters, which may last for two or three days. After such a lashing storm, it is prudent to examine the interior and exterior of a building for weather penetration.

For leakage through walls that is not the result of faulty flashings, open coping joints, or poor calking, a practical and economical remedy is repointing of the imperfect joints, or "tuck pointing."



When Thayer Hall, at West Point U. S. Military Academy, was changed from a riding arena to an academic center, old walls were retained but completely renovated. Seen at left from Hudson River side, walls have height equivalent to ten stories.

Properly done, and at the appropriate time, this will prevent more serious and more costly damage.

It is at the spandrel beams and exterior columns in masonry walls that sound waterproofing is especially needed. If these locations are unprotected, serious damage may result from the pressure exerted by rusting steel. Cases have been found where this expansive force has thrown parapet walls as much as 5 in. out of plumb, dangerously weakening the entire wall. On some buildings, where defective coping joints have been exposed to the weather for years and allowed to deteriorate, repair consisted of taking down the parapet walls, exposing the roof beams, cleaning off the rust and scale, and waterproofing the beams with a membrane covering. Then the masonry had to be rebuilt to match the original construction. This costly procedure could have been prevented had corrective measures been taken when the first signs of openings in the parapet walls or coping joints were noticed.

The Larson system, introduced by the Brisk Waterproofing Company in 1934, and now widely used for brick-faced walls, eliminates this problem. In this system, a series of overlapping, prefabricated impregnated felt membranes are placed within the wall itself during erection. Any moisture that enters the masonry can penetrate to a maximum depth of 4 in. Here it encounters the membrane and is forced, by gravity flow, to seek ground level, where it is discharged to the outside through weep holes.

To correct open coping joints, the joints should be cleared to half or three-quarters of an inch in depth, filled with a high-grade calking compound and then topped with a lead weather cap. When coping joints are completely open, a waterproof cement mortar is first applied to within three-quarters of an inch of the surface before application of the calk and cap. Well-installed lead weather caps have been inspected after more than 15 years of service and found still in prime condition.

The whitish deposits or "efflorescence" that sometimes appear on masonry walls generally mean that the walls are not entirely watertight. Soluble salts in the masonry are being deposited on the surface as the water evaporates, another warning sign that may call for closer examination by the alert engineer.

Nowhere is the value of remedial waterproofing more graphically shown than in the new ten-million-dollar Thayer Hall at the U.S. Military Academy at West Point, N. Y. Here an ultra-modern school building has been built inside the original block-long mass of gray granite walls that formerly enclosed the old Riding Hall—one of the largest stone structures of its kind in the world.

The stone walls, built in 1911 at a cost of $678,000, were restored to a structurally sound condition by proper weatherproofing of the entire exterior. The weatherproofing was done with scaffolding rigged from the parapets since the roof had been removed and only the sheer free-standing walls, 10 stories high, remained.

Loose, soft, crumbling mortar was removed with power-driven rotary carborundum blades. The debris that remained in the cavity was removed by wire-brushing. The joint and surrounding area were soaked with water to insure a better adhesion of new mortar to existing mortar and stone. Specially prepared, low-shrinkage mortar was used to prevent the development of separation cracks through which rain water could penetrate and repeat the deterioration process. New mortar was packed into place until the joint was flush with the surface. The finished joint was tooled smooth to help it shed water. Throughout the project, special attention was given to matching and blending the new mortar with the old.

Curtain-wall structures

The factors that bring about leakage in curtain-wall systems are quite different from those encountered in masonry construction.

For one thing, curtain walls are subject to various kinds of movement not found in conventional masonry walls. For example, the coefficient of expansion of aluminum is much greater than that of glass—about 2½ times as much—while that of steel is intermediate. This means that an aluminum-to-glass joint will have much more relative movement than will a steel-to-glass joint, requiring a sealant or glazing compound with superior elasticity and adhesion. The difference in expansion between a 10-ft sheet of glass and an aluminum frame is 1/16 in., in a normal range of temperatures.

Also, there is the movement of the panels themselves, and the possibility that whole sections of wall will move. Wind pressure, too, causes measurable movement of panels. Large panes of glass may move in the center, under the influence of strong winds, by as much as 1¾ in. in a 5-ft x 10-ft pane. This pulls the edges of the glass away from its seal, often causing joint failure.

The size and weight of panels in curtain walls and the way they are attached often put too great a load on the sealant. In many cases, the sealant is expected to support and hold glass or metal panels in place, a job no sealant was ever designed to do. Sometimes also, in poor design, the space allowed is inadequate for a sufficient amount of sealant or the wrong type of sealant is specified.

Expansion and contraction, lateral movement, excessive loads, and wind pressures put added stress on the sealant. These conditions plus the commonly known inadequacies of oil-type calking and glazing compounds—hardening, shrinkage, loss of solvent, bond failure—compound the difficulty of obtaining a weathertight, lasting seal in curtain-wall joints.

At a workshop held during the Building Research Institute's Eighth Annual Meeting last April, a manufacturer of polymeric sealants listed several causes of window leakage in curtain-wall construction.

1. Glass was inserted from the inside, and the bed of putty or compound on the outside had cracked and fallen out.

2. Glass was installed from the inside of the building, and the face glazing on the outside had loosened, cracked, or fallen out.

3. The number of securing devices used, such as glazing clips, was inadequate.

4. The glass was cut wrong, or was cut too small for the opening.

5. The windows were fitted improperly into the openings, and were warped, or the frames were too light in weight for the size and weight of glass used.

6. There was excessive movement due to wind pressure.

7. The wrong type of sealant or glazing compound was used.

8. An insufficient amount of compound or sealant was used.

9. The surface was not completely dry. Glazing was done in wet weather; the sash was wet; or the glass was placed while there was condensation on the sash.

10. Workmanship was careless.

11. The channel was not properly filled or the glass was not centered or secured properly, or an auxiliary seal was omitted where its use was indicated.

12. There were open joints in the mullion, at the lintels, or there were open curtain-wall joints—butt joints or miter joints—in the grid work.

All these causes of leakage fall into one or another of three categories—inadequate design, inadequate materials, and inadequate application.

A good way for engineers to eliminate these causes of leakage is to weigh the five factors listed below before writing specifications for sealants and their application:

1. Consider the movement of the joint to be sealed. This includes thermal movement, wind-pressure movement, as well as displacement due to vibration, shock, and abrasion.

2. Consider the characteristics of the glass as they affect the choice of sealant, that is, the total allowable variation for the extrusion and for the glass; how the surface finish may be affected by sealant components; and the possibility of discoloration due to oil migration or staining.

3. Consider the design and finish of sash and frame—the need for sealing mitered and butted corners; the size, type and placement of stop, molding, bead or angles; the possibility of sill de-

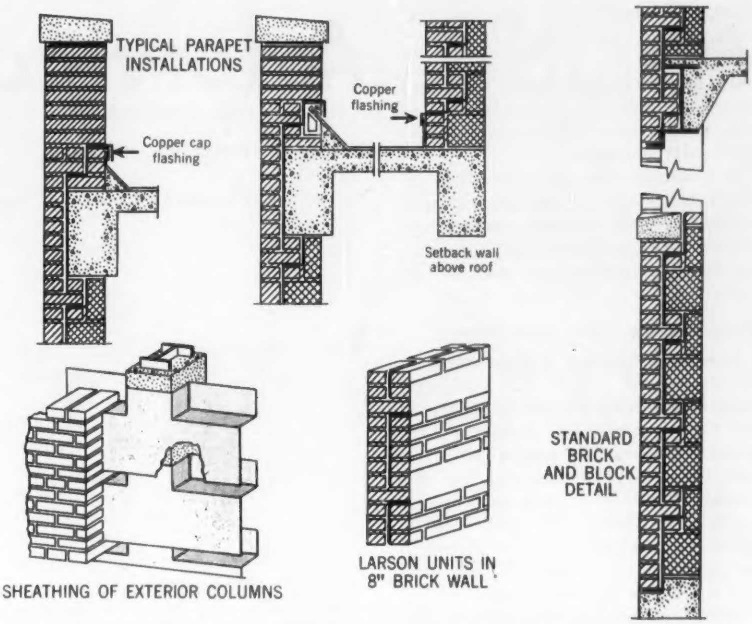
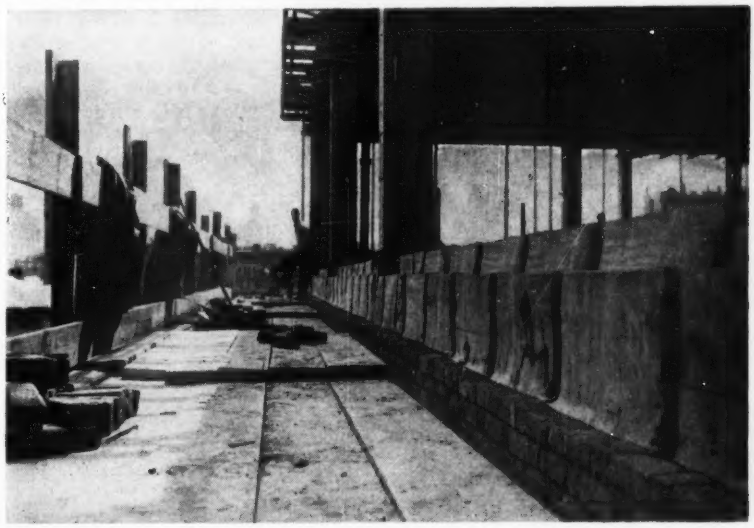


FIG. 1. Proper methods of waterproofing for brick and masonry walls at time of construction, by means of pre-formed units, are shown.

Impregnated felt units that characterize the Larson waterproofing system are installed during the construction of the wall to prevent water penetration. Here they are being installed in the Museum of Natural History, Boston, Mass.



flection with larger, heavier lights; the surface finish and its effect on sealant adhesion.

4. Consider location and environment—exposure to ultraviolet radiation, temperature extremes, and atmospheric contaminants.

5. Consider the characteristics of available sealants for performance and cost—degree of hardness on setting, elasticity, temperature range, adhesion, resistance properties, and most of all, service life.

Waterproofing after construction

In some instances, it is more practical to waterproof curtain-wall buildings after construction is completed, when the time required for proper professional waterproofing cannot interfere with the speed of modern building operations. This in no way reflects on builders or architects, for speed is needed in new construction, while thorough waterproofing is an exacting task that can easily slow up construction.

Waterproofing after construction permits investigation and evaluation of different types of sealants, and there are a great many of these. This is one field where research and development are producing a continuous flow of new products, reflecting again the awareness on the part of sealant manufacturers of the problems of waterproofing curtain walls. Waterproofing after construction is desirable because it allows time for the workmanship of experts with engineering experience, which assures a sound, enduring job.

Conclusions

From the standpoint of waterproofing, then, the factors that will result in a weather-proof, watertight building, whether of curtain-wall or masonry construction, are:

1. Understanding of the design and construction of the building.
2. Complete information on the many sealants available, including their strong points and limitations.
3. Clear, detailed specifications.
4. Coordination among the several participants and the specifying authority—contractor, sealant manufacturer, glazier, waterproofing contractor, erector.
5. An experienced crew of skilled mechanics, properly supervised, with practical on-the-job interpretation of specifications. The work must be done efficiently and quickly, using proven methods.

It is the business of the waterproofing industry to solve problems of leakage in buildings, masonry and curtain-wall, new and old, through the use of proper techniques, suitable sealants and qualified mechanics.

A low-cost home

HERBERT A. SAWYER, JR., F. ASCE

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Should America suffer a major attack by an enemy with nuclear bombs, practically the whole nation would be blanketed by lethal fallout radiation within 24 hours. Thus, fallout shelters are needed everywhere. Designs for family types, developed by the Office of Civil and Defense Mobilization (OCDM), are readily available from the OCDM, Battle Creek, Mich. (pamphlet MP-15, June 1959).

But blast and fire are nuclear-weapon hazards almost as serious as fallout. The Atomic Energy Commission reports (in *The Effects of Nuclear Weapons*, 1957) that a 20-megaton bomb (similar in magnitude to weapons tested several years ago) would cause instantaneous fire in almost any dry and exposed paper, cloth, or light vegetation within a radius of 25 miles. And the blast from such a bomb, producing a lateral loading of 1.5 psi (216 psf) at an 18-mile radius, would cause at least partial collapse of conventional wood-frame housing within this radius. At a radius of 13 miles, the loading would be about 2.5 psi, causing at least partial collapse of conventional masonry housing (and the usual masonry fallout shelters) within this radius.

A majority of Americans live within one or more of these distances from the center of a metropolitan area or other possible target. Thus, a shelter designed to protect the family from fire hazards and a reasonably high blast loading, as well as fallout radiation, is necessary, and the cost of such a shelter should be within the means of the average family.

The shelter here described, designed to meet these specifications, consists essentially of an underground chamber in the shape of a truncated cone, made of solid sand-gravel concrete blocks (or brick) with a reinforced concrete roof. See Fig. 1. It is constructed adjacent to the basement wall of a residence, with a hole in this wall for normal entrance and exit, and a manhole in the ceiling for emergency exit. Not more than six people should occupy this shelter.

For shielding from radiation, this shelter satisfies the recommendation of the OCDM for its most substantial shelters, that any straight-line radiation from the exterior should have to pass through 300 lb of material per sq ft. To meet this standard at the entrance, the basement space is assumed to have one-third of this shielding, and an eight-block emergency barrier, laid up without mortar, must be placed in the entrance after the blast wave has passed by. At distances from ground zero for which this shelter provides blast and fire protection, neutron and initial gamma radiation are usually not significant. For residual gamma radiation, mostly from fallout, the attenuation factor of this shielding exceeds 1,000, that is, less than one part in 1,000 gets through.

In the design of this shelter, it was assumed that the attached residence would burn completely. The wall shielding the entrance and the emergency entrance barrier would protect the occupants from heat radiation and minor explosions. It is believed that, with fire, gas pressure in the basement space at the low level of the entrance opening would probably be less than atmospheric, but the forced-air ventilation system would keep the occupants safe even if this pressure should slightly exceed atmospheric. Since the hazard from fallout following a bomb detonation is not less than that from fire, use of the emergency-exit manhole would not increase survival probabilities. Thus, this manhole is included primarily for psychological purposes, and it may be regarded as an optional feature.

For blast resistance, this shelter owes much of its strength to the shape of its shell walls. Although its wall can resist a uniform external pressure of about 300 psi, compared to the resistance of about 3 psi of the usual unreinforced 8-in.-masonry wall, this comparison exaggerates the strength of a shell wall for the unsymmetrical, dynamic loadings of blast. The writer has calculated that this wall could resist an air overpressure from nuclear detonation of as much as 50 psi. This figure was arrived at using information from

shelter from nuclear blasts

Newmark on the relation between external pressure and required structural resistance, from Benjamin on strengths and stiffnesses of masonry walls, from Anderson on magnitude and timing of overpressures, and from Murphy on the relation between overpressures and underground stresses (ASCE *Proceedings* Papers 306, 1254, 1836, and 1837, respectively).

Favorable factors partially considered in this analysis were the prestressing effect of the soil pressure on the shell, and the passive resistance of the soil to the deformation that must accompany any probable mode of failure. Because of rough approximations throughout this analysis and the lack of actual weapon tests on this type of wall, the introduction of a further safety factor of 2.5 is recommended, giving this wall a 20-psi overpressure rating.

Roof design was also based on much of the above information, as well as ultimate-strength methods, yield-line theory, and ACI Building Code requirements. On this basis the roof was calculated as able to resist an overpressure from nuclear detonation of 17 psi. However, membrane action, the

Notes on Fig. 1

Wall is of 8-in. masonry, solid sand-concrete block or brick.

Reinforcing bars are intermediate grade, with ASTM A 305 deformations.

Roof concrete has minimum strength of 3,000 psi at 28 days: 4 cu yd are required.

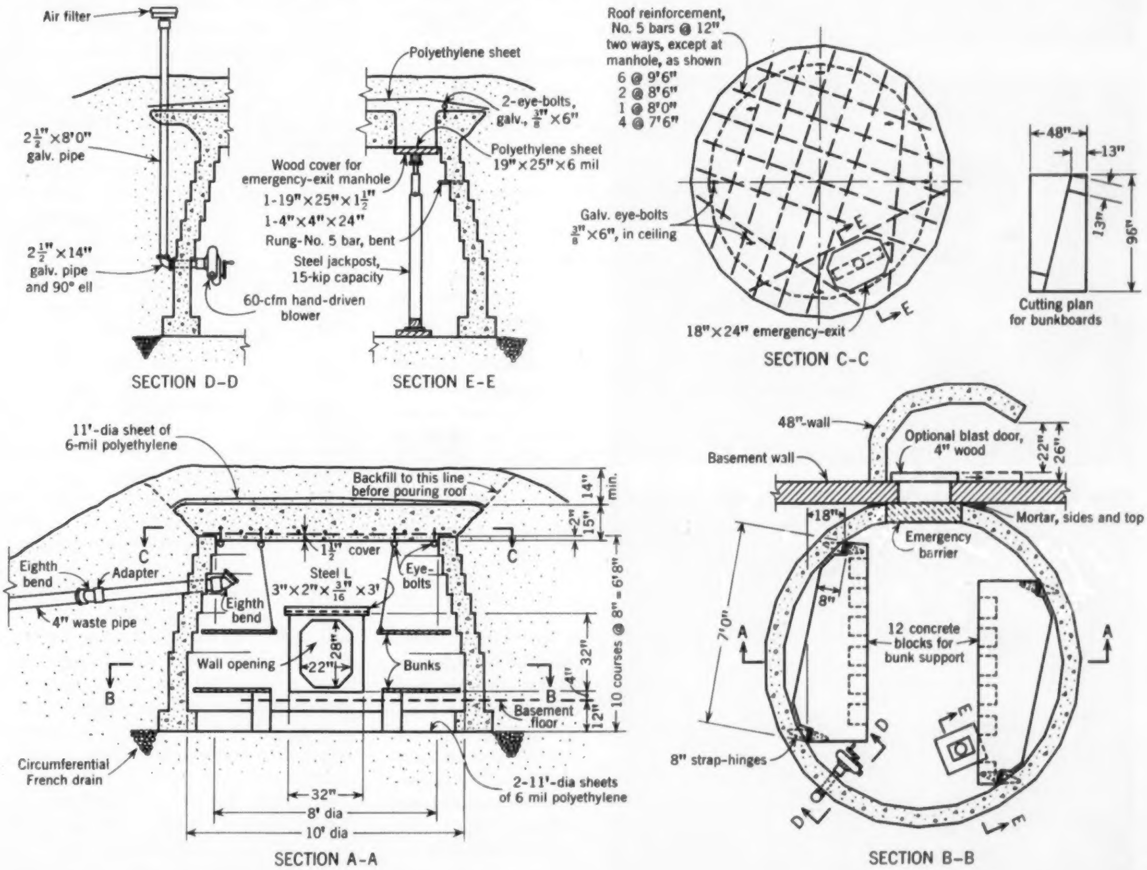
Waterproof coating for outside of wall is of hydrolithic type.

Overpressure rating is a minimum of 17 psi (probable ultimate is greater than 25 psi) for a 20-megaton weapon.

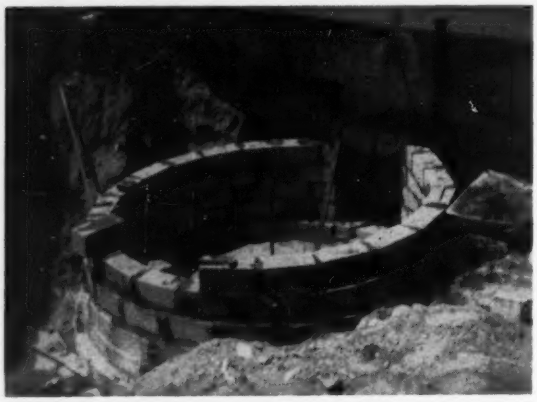
Effective radius from ground zero is 4.5 miles for a 20-megaton weapon.

Residual radiation attenuation factor rating is 1,000.

FIG. 1. Home shelter from nuclear blasts is shown in plan and sections.

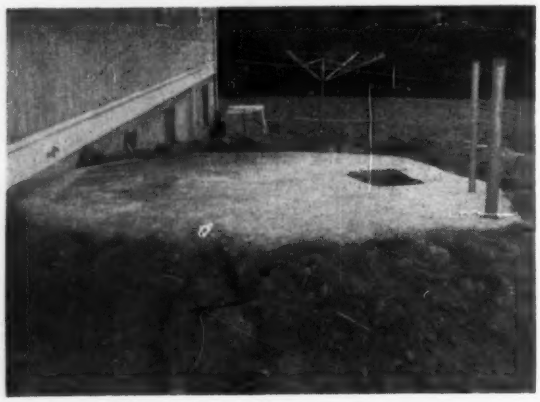


Blocks in first course are laid with ends pointing in, to provide a footing, all other courses with blocks end to end. Concrete-block footing and soil floor with plastic cover contribute to low cost.



Access hole into adjacent excavated basement was cut with pneumatic tools. Central pole with radial wire is a useful guide to the mason. Here shell is half completed.

Shell of shelter is complete. Active pressure of backfill will somewhat "prestress" it. Blocks do not have to be laid up as accurately as those for an exposed flat wall.



A soil dam or levee provided the side form for the roof pour, here seen completed. Manhole will be filled with fine soil or sand. Larger pipe is vent intake. Smaller emergency exhaust pipe was omitted from final design as unnecessary.

conservativeness of the 0.25-percent minimum steel requirement of ACI, and the probable excess of yield point over 40 kips per sq in. for impulsive load, all tend to increase the roof strength and bring it into balance with the 20-psi wall rating. If a higher blast resistance is desired, No. 6 bars can be used in place of No. 5 bars, thus increasing the calculated overpressure strength to 31 psi.

A shelter with an overpressure rating of 20 psi provides blast protection from a 20-megaton weapon for radii exceeding 4 miles. Assuming that significant structural or fire damage, and resulting casualties to inhabitants, will be suffered by conventional residential construction at all locations within 18 miles of ground zero, use of such shelters reduces the area suffering casualties to about one-twentieth its unsheltered size. This fraction is practically constant for all sizes of nuclear weapons.

Although little information is available on the subject, it is possible that the sudden compression of nuclear-weapon blast waves with overpressures exceeding 10 psi may cause direct injuries to the human anatomy. These waves occur within a 5.5-mile radius from the detonation of a 20-megaton weapon. Prevention of these injuries in the area between the circles of 5.5-mile and 4-mile radius (representing a reduction of one-half in their area-wise probability) would be effected by a wooden blast door, to be rolled on casters and in light wooden guides, across the entrance opening. Then any pressure increase would be transmitted into the shelter (primarily through the vent and waste pipes) slowly enough to avoid injuries. This door, optional for shelters more than perhaps 10 miles from a potential target, could be built up of 30-in. 4 x 4's spanning the 22-in. opening.

To avoid a deadly blast of soil and stone through the waste pipe in this situation, the outside end of the pipe should be covered with a concrete block. Soon after the blast wave, the block should be pushed back; then also the filter should be screwed onto the vent inlet.

In construction of the shelter, the concrete blocks of the first course are laid on a thin mortar bed on the edge of the double-thickness polyethylene floor sheet, with their long dimension in a radial direction to provide a footing. The floor sheet should be protected during construction with a corrugated cardboard or plywood covering. The mason must also be instructed to place the bunk-hinges, the short 2½-in. vent pipe, the ladder rung, and the 5-in. square opening for the waste

pipe in their proper places in the wall. The remainder of the vent pipe and the waste pipe can be placed just before or during the backfilling of the wall. Before the ceiling forms are placed, the bunk-boards and any other large items should be placed in the shelter from above.

Ceiling forms for the roof-pour may be two 4-ft x 8-ft sheets of ¾-in. exterior-grade plywood, cut to fit within the top wall-course by saber-saw. These sheets can be supported on three parallel 4 x 4 timber stringers 34 in. on centers. The stringers should be supported by six 4 x 4 posts and one jackpost (used later for the manhole), three used for the center stringer. The ceiling eye-bolts may be placed in drilled holes in the plywood-form sheets before pouring. Notches are later chiseled at these bolts to permit stripping of forms. After the forms have been removed, the manhole jackpost and cover can be placed and the manhole filled with fine dry dirt or sand. Adjoining pieces of the jackpost-manhole assembly should be secured against any relative lateral displacement that might accompany an impulsive loading.

Although concrete blocks of standard nominal 8 in. x 8 in. x 16 in. size were used for the prototype shelter, the use of a specially shaped block with a 2-in. taper in the 16-in. dimension will reduce the mortar space between blocks in the shell-wall, with consequent savings in mortar and mason's time, and an increase in strength.

The nominal cost of all materials and equipment for the shelter, including bunks and a complete ventilating system, is approximately $340, as itemized in the accompanying list. Skilled labor and use of construction equipment, including excavation, pneumatic breaking of entrance hole, mason-and-helper, and backfilling, cost $115 for the prototype shelter. This cost should probably not exceed $150 even in relatively high-cost areas. Additional labor, including carpentry, ditching, painting, and cleaning up, should not cost over $150, and could be done by a do-it-yourself owner. Thus, the cost of materials and labor for this shelter is from $450 to $650—a cost for permanent survival insurance well within the means of the average family.

The suggestion of the blast door by the OCDM is gratefully acknowledged, as well as the interest and suggestions of other civil defense officials and several of the writer's colleagues.

Further information on preparations for survival in an emergency, including outfitting of a shelter, is available from local civil defense offices.

Completed shelter is seen through basement opening. Upper bunk boards, here in sleeping position, may be lowered to provide back-rests for occupants seated on lower boards. Six people can occupy the shelter, which has a total cost in the $500 range.

Bill of Materials for Nuclear-Weapon Shelter

NO.	MATERIAL	COST
280	solid sand-concrete blocks, 8 in. x 8 in. x 16 in., @ 30 cents (or 300 blocks, tapered, 8 in. x 8 in. by 14 to 16 in.)	$ 84.00
10	solid sand-concrete blocks, 4 in. x 8 in. x 16 in., @ 20 cents	2.00
15	bags, masonry-cement @ $1.35 (11 bags for tapered blocks)	20.25
3,000	lb of sand (2,200 lb for tapered blocks)	6.00
4	cu yd of ready-mix concrete of 3,000-psi minimum 28-day strength, @ $13.00	52.00
40	lb of hydrolithic waterproofing compound	5.00
4	exterior-grade plywood sheets, 4 ft x 8 ft x 3/4 in., @ $10.30	41.20
1	piece of used lumber, 4 in. x 4 in. x 8 ft 0 in.	1.30
8	pieces of used lumber, 4 in. x 4 in. x 6 ft 0 in.	8.00
1	steel angle, 3 in. x 2 in. x 3/16 in. x 3 ft 0 in.	1.50
6	deformed reinforcing bars, intermediate grade, No. 5 x 20 ft @ 3.30. Cut six @ 9 ft 6 in.; two @ 8 ft 6 in.; four @ 7 ft 6 in.; one @ 3 ft 0 in. (for rung). Lap-splice two 5-ft remnants to make one @ 8 ft 0 in.	19.80
8	strap hinges, galvanized, 8 in. @ 70 cents	5.60
10	galvanized steel eye-bolts, ⅜ in. x 6 in.	1.10
1	steel-pipe jackpost, minimum capacity, 15,000 lb. (or 6-in. x 6 in. wooden post and wooden wedges)	9.50
23	ft of polyethylene plastic, 20 ft wide x 0.006 in. @ 50 cents	11.50
1	standard galvanized pipe, 2½ in. x 8 ft 0 in., threaded both ends, @ 90 cents per ft.	7.20
1	standard galvanized pipe, 2½ in. x 14 in., threaded both ends	1.50
1	galvanized 90-deg ell for 2½-in. standard pipe	2.00
2	galvanized couplings for 2½-in. pipe @ $1.42	2.84
1	hand-driven blower, 60 cfm (through particulate filter), No. 60-A of Champion Blower and Forge Co. or equivalent	41.75
1	dry particulate air filter, automobile type, 2⅝-in. diam outlet, Sears Roebuck, No. 24996, or equivalent	9.00
1	solid fiber (orangeburg) drain pipe, 4-in. diam x 8 ft	3.76
2	one-eighth bends for 4-in. fiber pipe @ $1.75	3.50
1	adapter for 4-in. fiber pipe (tapered to cut end)	1.05
2	casters, 2-in. non-swivel rubber wheel (for optional blast door) @ 60 cents	1.20
	Total	$342.55

Dome fabrication was started at the top, on falsework, with assembly of hexagonal panels and exterior pipe framework.

DOME BUILT FROM TOP DOWN

REIGN C. ULM, Manager, and **RALPH L. HEATHCOTE**, Project Engineer

Product Research Department, Graver Tank & Manufacturing Co., East Chicago, Ind.

Peripheral thrust ring 384 ft in diameter is to carry the dome after it is erected to full size.

Supported during construction on 1.5 oz per sq in. of air pressure, a geodesic dome of 384-ft diameter has just been erected from the top down. The all-welded steel structure, 117 ft high inside, is to house the tank-car repair operations of Union Tank Car Company at Wood River, Ill. It is being constructed by a division of that company, Graver Tank & Manufacturing Co. of East Chicago, Ind. The dome encompasses 110,000 sq ft of entirely open area, with no interior columns. This permits completely unobstructed layout of car tracks and facilities over the 2½-acre enclosure. A sandblasting and paint tunnel 208 ft long on an outgoing track is an attached structure, also of geodesic design, where repair and painting of tank cars is completed.

An exterior pipe framework provides the geodesic truss supports for 804 hexagonal steel panels, each about 15 ft across. The panel steel is 11 gage (less than ⅛ in.), and the pipe is 6 in. in diameter, Schedule 10 (about ⅛-in. wall) with a fabricated endpiece for welding to a plate at the cen-

ter peak of each panel. The panels and the frame were erected together. Erection started on a pipe scaffold 30 ft high for a first stage, until the dome construction reached 200 ft in diameter and was then transferred to air support.

Cranes assembled this center section, which covered about 20 percent of the total dome area; then jacks took over at the periphery to support the central section. The pipe scaffolding was removed, and a DuPont nylon fabric 1/32 in. thick, with exon plastic coating, was attached to the under side of the dome on a 175-ft circle.

The curtain was installed to hang loosely to the ground, and—with the erected section of the dome and the ground beneath—formed a balloon-like enclosure. Thus a complete bag was not needed. The fabric was hooked to 3 × 3 × ¼-in. angles bolted to the under side of the dome, with a sealing flap cemented to the steel dome.

The selection of this special fabric —and indeed the engineering studies for supporting this structure pneumatically during erection—were the result of the interest of Union Tank Car Company in this method. Procedures were developed by Norman R. Seaman, President, and C. F. Schwall, Jr., Consultant, of Domestic Film Products Corp. of Millersburg, Ohio. This firm fabricated the plastic curtain for the pneumatic support. Their analysis of the stresses in the fabric follows.

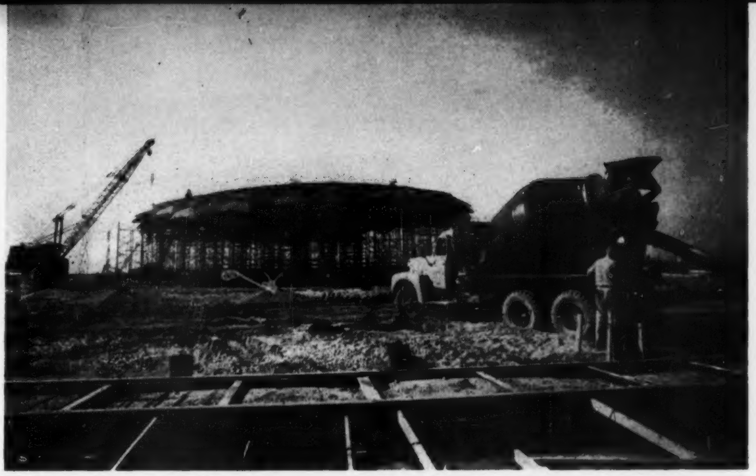
Referring to Fig. 2, the curtain at maximum size would have a section radius R of 12.5 ft and a radius of revolution of 165.6 ft. If no vertical convolutions were employed, the curtain would take the shape of a smooth toroidal shell, and fabric stresses would be as shown in Figs. 1 and 2.

In Fig. 1,

$$F_t = \frac{PA}{2} \times \frac{2B + A\cos\theta}{B + A\cos\theta}$$

$$F_L = \frac{PA}{2}$$

(from Hadekel, *Notes on Pneumatic*



Pipe scaffolding 30 ft high supported the center section of the dome at the start of construction.

Tires). Here,

$R = A$ = section radius, in.
B = radius of revolution, in.
θ = angle (deg) to point at which stress is to be determined
P = internal pressure, psig
F_t = transverse stress, lb per in.
F_L = circumferential stress, lb per in.

At the dome balance pressure of 0.087 psig, with $\theta = 90$ deg,

$$F_t = 13.1 \text{ lb per in.}$$

$$F_L = 6.55 \text{ lb per in.}$$

Although the fabric tensions, as shown, were completely safe when considered in relation to the tensile strength of the fabric, they are of considerable magnitude compared to the seam strength of the electronically welded fabric assembly. Tests indicated that seam slippage could occur at seam tensions of about 20 lb per in. when the load was applied in the circumferential direction at seam temperatures in the neighborhood of 150 deg F. The curtain was patterned so that the 6.55-lb per in. tension was in the circumferential direction, resulting in about a 3 to 1 safety factor.

It was decided, however, in view of the possibility of higher operating temperatures and slow "creep" failures, that a higher safety factor must be achieved. By providing excess surface in the curtain and then pulling this excess radially inward with main adjusting ropes, the smooth shell of the torus could be formed into 326 vertical convolutions, each to be considered a sector of a toroidal shell of about 4-ft section radius and 22-ft radius of revolution.

At an angle $\theta = 45$ deg (Fig. 1), the tensions in this surface would be $F_t = 3.9$ lb per lin in., and $F_L = 2.1$ lb per lin in., F_t being in the circumferential direction. The seam safety factor would become 5 to 1, which was considered adequate.

The curtain material was delivered to the job site in 10 gores, each about 100 ft long by 95 ft wide, for the upper section. Ten additional gores, 100 ft x 100 ft, were also provided. These were attached as the dome was raised and the area enlarged. A short chain at frequent intervals held the gores together; reasonably air-tight joints at both vertical and horizontal splices were made by a plastic flap welded to the gores and stapled together over the opening. The material—nylon fabric coated with exon—was woven, coated, and fabricated by Domestic Film Products Corp. It proved extremely resistant to abrasion, withstanding the air-borne sand that continually blew around the restraining ropes through-

FIG. 1. If no vertical convolutions were present, the curtain would take the shape of a smooth toroidall shell, with fabric stresses as given in text.

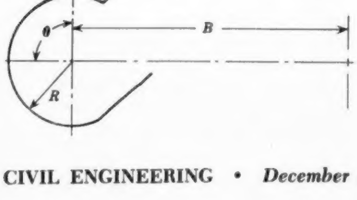


FIG. 2. Curtain at maximum size has section radius of 12.5 ft and radius of revolution of 165.6 ft.

As the dome is raised, the ropes are tied to a center ring to hold the lower end of the fabric. Air pressure holds it tight against the ground.

out erection. The fabric does not support combustion—there were welding operations continuously within inches of the fabric. It is tough—it lay in water and ice during the winter months.

At the start, 256 manila ropes of ⅞-in. diameter were attached to the steel angle holding the fabric in place. These were in a vertical plane and were carried around outside the bag and back to the center of the dome to a holding ring. This ring, 3 ft above ground level, was of 4-in. pipe on a circle of 40-ft diameter. A second ring was added later just above floor level, to avoid raising the edge of the curtain above the ground and thus reducing air loss under it. As construction progressed, 70 additional manila ropes were added around the bag as reinforcement.

The plan for the work was to raise the complete dome by increasing the effective piston area of the bag. This was done by releasing the restraining ropes from the center ring and letting the lapped curtain out to a larger diameter. A single vent of 5-ft diameter at the apex of the dome was regulated to control the air-supported structure. It was closed when the structure required raising. It was rigged so that, as the dome moved upward, larger volumes of air were released. This increase controlled the upward movement and slowed it to a stop. Other vents were tried, but the single, manually controlled vent at the zenith was found most effective.

Air supported 90 percent of the weight of the dome; jacks held up the remaining 10 percent and kept the structure stable. Criss-crossed cables, attached to the upper portion of the dome, extended through blocks and falls to anchors at some distance from the dome. They were designed to prevent twisting and to hold the dome securely against an 80-mph wind. The maximum wind experienced during construction was 45 mph.

Steel in the structure weighed 560 tons, and the plastic curtain 28,000 lb. Hexagonal panel units and pipe struts were added by boom tractors and welded before the steel panels came in contact with the curtain.

The nearly completed dome is seen with the paint tunnel in the foreground. The fabric bag temporarily closes the 191-ft-wide, 23-ft-high opening for six railroad tracks.

A 25-hp motor drove a propeller-type ventilating fan outside to deliver air to the center of the dome through a multi-plate culvert of 60-in. diameter placed below floor level. The full capacity was discharged continuously, with regulation at the discharge vent. The flow of air, besides providing the necessary pressure, also gave some cooling to the interior. Personnel access was through the simplest of air locks—a small steel box with two inward-opening doors without gaskets, set into the side of the culvert. Air pressure held the doors closed, but they could easily be pushed open, one after the other, to enter the lock. Personnel could readily walk through the air stream to reach the center of the dome or to return.

The volume of air from the single blower was of such quantity that minor air losses were unimportant. A standby unit, always connected for automatic starting, was actually required only once. Each unit could provide 20,000 cfs against a 4-in. static head of water, but operated against a maximum of 2.70-in. head of water, or 1.56 oz per sq in. of pressure. Power came from an outside commercial source, but two Murphy diesel-electric units were connected for possible emergency use.

Air loss not serious

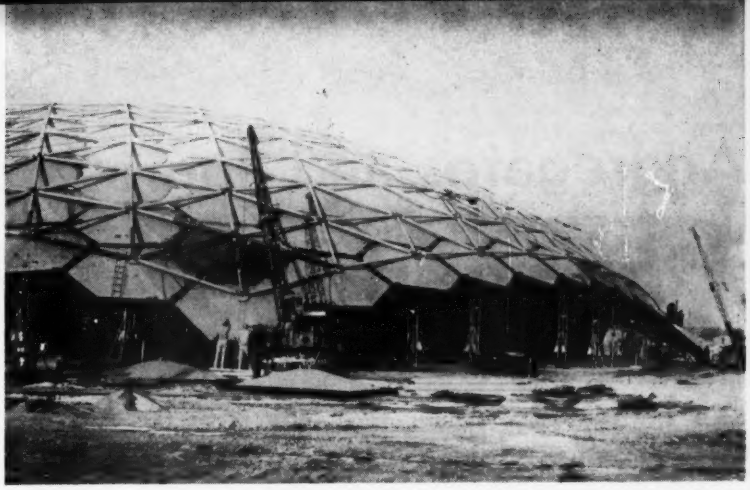
Twice there were substantial air losses from under the dome, but neither loss proved serious. One occurred when the first length of fabric, shortened to only a 16-in. contact with the ground as the dome was raised, permitted air to escape under it. The second blower was used for a short time until the additional 100-ft length of fabric was attached. Another air loss occurred when hot weather raised the temperature on the steel to 147 deg F, and the air inside to 117 deg F. This heat melted the adhesive that attached the fabric to the steel. Repairs were made during the cooler night temperatures, and water was sprayed on the connection during the hot-weather construction period.

Two emergency "balloons," one 8 ft in diameter and one 12 ft, were kept ready inside the dome to plug any serious failure. They could be pushed into an escaping air stream and would be held in place against the curtain by air pressure. These balloons were never needed during construction. A 26-in. gash was accidentally cut in the curtain by the sharp edge of a steel panel, but the fabric did not rip nor did the hole enlarge.

Raising the dome was a time of spe-

cial activity. Guy cables were slackened uniformly around the dome by the amount required for the desired lift. An intercommunication system was so arranged that the man in control of the raising, stationed inside the bag, was in contact with the foremen all around the outside. They kept him informed of the amount of movement that was taking place. By such direction, through the adjustment of the cables on all sides of the bag and of the jacks around the edge of the partially completed dome, the whole structure was kept very close to the planned location—even though it was actually floating on air.

The door structure, large enough to accommodate six radiating railroad tracks, was framed in during construction. The supporting air curtain worked satisfactorily across this wide opening, 191 ft in length and 23 ft high.



Boom-tractor adds a panel as hydraulic jacks in three-pipe frame stabilize the dome structure, which is still supported on air.

Supported on thrust ring

The completed dome structure rests only on a peripheral thrust ring 1,175 ft in circumference. This is a heavily reinforced circular concrete beam set on vertical concrete piles spaced in a circle at intervals of 4° 30′. The ring takes the horizontal thrust so that battered piles are not necessary. It has a steel-plate top, 4 ft 1 in. wide and 5/8-in. thick, to which the struts and bottom plates are welded. A tolerance of 6 in. out of plan location was permissible. The structure was erected within 1 in. of its dimensional size.

When the structure was completed, except for welding it to its base ring, the air pressure was raised to 2 in., and the entire dome was floated on the bag. At this point the first readings of the strain gages were made. This was the zero or basic reading, with the stresses in the structure reversed; the struts of the dome were in tension and the panels in compression. The next reading was taken when all the struts and the main columns of the doorway were fastened securely to the base ring and while the panel edges were floating free about an inch above the foundation. Next the air pressure was again raised to a 2-in. static head, and a set of check readings was taken for comparison with the first and to reveal changes in stresses.

The pressure was then reduced in steps, to put 25, 50, 75 and 100 percent of the load on the foundation. Gage readings were taken at each step, translatable to a loading on the different members of the dome, in pounds per sq in. A total of 260 gages were used. Of these, 30 gages were located on top, and 30 on the bottom, of three selected panels, and four gages each on a set of six struts around the panels and on two other struts located below two of the test panels. The test areas were located on approximated thirds of the circumference and on the second ring of panels above the foundation.

During these tests, a careful watch was kept to observe any movement of the dome, either radial or vertical, as it was set on its foundation. These checks were made from monuments and reference points established during the initial layout of the dome. The greatest movement noted was in its center height, which settled 1¼ in. from full air support to self support on the foundation.

Technically the dome is a segment of a sphere, designed and constructed of steel as a three-dimensional curved truss. The truss, about 2 ft deep, is designed as a unit cell system of hexagons in which the involuted 11-gage sheet-steel surface material is employed both as the weathering surface and as the inner-member tension system of the truss. The outer triangular array is composed of 6-in. steel-pipe sections. The panels were fabricated at the East Chicago, Ind., plant of Graver Tank & Manufacturing Co. and made into the hexagonal shape in the shop before shipment.

Inside the dome there will be nearly half a mile of repair track with individual specialized repair-track positions, corresponding to the spokes of a giant wheel. These include tracks for tank cleaning, car repair, and tank repair. A Whiting transfer table, which accommodates a single tank car, will move in a circular course around the interior structure on a path 50 ft wide, between the materials storage area and the repair areas. It will deliver the tank cars to the various repair stations. The transfer table will be off center within the dome to permit variable spaces for different services. There are four incoming tracks and two outgoing tracks, one of which leads out through the paint tunnel.

The paint tunnel, or "finishing shop," connects with the main dome and is fabricated of panels similar to those of the dome. This tunnel is 208 ft long, 40 ft wide and 22 ft high. It covers one of the outgoing tracks and is the last stop for cars that require painting and stenciling. A grit-blasting unit prepares the cars for painting in six to seven minutes. The overall operation in the paint tunnel is mechanized so that a car can be completed in from two to three hours, as compared to three work days by conventional methods.

The dome at Wood River is very similar to the dome built a year ago by Union Tank Car Company at Baton Rouge, La. In purpose and size they are almost identical. Both are for repair and maintenance of the company's huge fleet of railroad tank cars. The Wood River operation, one of the major maintenance and car repair plants in company's total network of 23 shops and repair points throughout the United States and Canada, handles inspection, maintenance, and repair of tank cars for an extensive area in the Midwest. It is located at Wood River because of the number of refineries there plus the many process industries in the nearby St. Louis area.

The Wood River Dome was designed and engineered by Graver Tank & Manufacturing Co., based on patents for geodesic structures held by R. Buckminster Fuller. George S. Hunt, industrial designer of New York, N. Y., is color and design consultant for Wood River. Battey and Childs, Chicago, is general engineer in charge of all construction other than the dome shell erection, which is under the supervision of Graver Tank.

Aggregates and aggravations of *heavy-weight concrete*

L. D. LONG, *President, and* **J. R. CLEMENTS,** *Vice President*

The Gulick-Henderson Laboratories, Inc., Flushing, N. Y.

The increasing need for high-density or heavy-weight concrete for nuclear shielding against radiation has brought new problems and new materials to the making of this class of concrete.

Heavy concrete is expensive, but a careful selection of available materials can often mean a substantial reduction in its cost. Since this cost may be $200 to $300 per cu yd, savings can be substantial. In contrast to the situation in conventional concrete, the cement may be the cheapest ingredient used as well as the lightest, except for water. Hence, one common inspection problem has been somewhat simplified.

A variety of aggregates have been used for heavy concrete; some are more suitable than others for the planned use. Usually the job of the commercial laboratory is to design the mix that is most economical overall, using either specified or acceptable aggregates to meet a minimum weight per cubic foot in place.

Among the aggregates used in projects with which our firm has had experience are:

1. Limonite	5. Steel punchings
2. Barytes	6. Steel sand
3. Magnetite	7. Ferrophosphorus
4. Ilmenite	8. Boron additives

Concrete weighing from 200 to 360 lb per cu ft is made with these aggregates. Limonite and barytes serve in the lower-weight range, magnetite and ilmenite are in the medium-weight field, and ferrophosphorus or steel punchings combined with magnetite or ilmenite are required for the upper ranges.

With the exception of ferrophosphorus, these aggregates do not affect the strength of the concrete. The strength remains more or less the same as that of average structural concrete, and there is no problem in meeting compressive strength requirements.

The chief aggregates used for heavy-weight concrete are:

Limonite. The reddish-brown iron oxide used in these investigations had a specific gravity of 3.6. It contained a high percentage of fines, and after washing returned to more or less the same state in time. The material was fairly soft and always remained dusty, apparently because of a slow process of surface disintegration. The finished concrete was orange colored and apparently sound.

Barytes. The barytes submitted for approval had a specific gravity of from 3.6 to 4.0, and was generally uniform in color but poorly graded. This material was evidently standard crusher-run aggregate. The theoretical weight of concrete from this material was 230 lb per cu ft. The barytes received contained many impurities. Plastic concrete made from it weighed 210 to 220 psf.

Magnetite. This dark colored iron oxide, Fe_3O_4, with a specific gravity of 4.4 to 4.7, was not prepared in sizes for concrete aggregates as originally used and therefore presented some problems in proportioning. The fine aggregate contained up to 20 percent minus 100, and the coarse aggregate was poorly graded, being deficient in the smaller sizes. The resulting concrete, placed at a consistency equivalent to less than a 3-in. slump, had excellent placeability and was vibrated into place with no difficulty.

Two peculiarities were noticed in the use of this aggregate. Many pieces exhibited magnetic qualities and developed beards made up of fine pieces, which apparently broke loose in the mixer. This reaction might cause some difficulty in intrusion-placed concrete, but apparently caused no trouble when the concrete was mixed.

Some pieces of coarse aggregate coated with cement paste were discarded and left in the open, exposed to the weather. After several months it was noticed that all such pieces showed heavy oxide growths extending out as much as ½ in. Excess concrete that had been loosely patted into place with a shovel turned brown and disintegrated after a few months. Other sections of magnetite concrete properly consolidated were also exposed to the elements, but showed no signs of distintegration or growth after six months, except for small surface spots.

Magnetite now available in the Rocky Mountains area is processed to meet specification requirements.

Ilmenite. By far the largest amount of aggregate used for heavy concrete, in our experience, consists of ilmenite ore (titanium and iron) from Quebec Province, Canada. Here open-pit quarries are operated for the exclusive purpose of producing heavy concrete aggregate. The specific gravity is 4.4 to 4.7. Making allowance for the fact that this ore is somewhat friable and that breakage is to be expected in handling, the aggregate sizes requested from the quarries for work at the Brookhaven (Long Island, N. Y.) laboratories were:

Fine	Medium	Coarse
— 100 to 4 mesh	½ to 1½ in.	1½ to 3 in.

The material between the 4-mesh and the ½-in. screen was returned for recrushing into fine aggregate, after which it was passed through magnetic separators to upgrade the density by eliminating the silica, with which much of the ore was streaked. Selecting the ore for crushing at the quarry was entirely a hand-picking operation. The

ore was found in veins only a few feet wide, and much rock had to be broken out to provide room for a truck to work back into the face of the quarry as ore and rock were removed.

Concrete weighing 245 lb per cu ft was made only with difficulty and after rejection at the plant of about half the aggregate. Later requirements for concrete weighing 240 lb per cu ft were met without trouble using all three sizes of aggregate. It was found that, contrary to original assumptions, the heaviest ore was near the surface, and the ore gradually became lighter with depth. This relative position was later found to hold for ilmenite at other localities.

Steel punchings. Steel punchings, which have a specific gravity of 7.4 to 7.8, are a by-product of fabricating shops and must be cleaned of oil and sweepings before use. Some oxidation of the surface is desirable for bonding purposes, but heavy coatings of rust have a pronounced effect on the weight of the concrete; in some cases the loss has amounted to 10 lb per cu ft. Punchings have little gradation and the percentage in a mix is governed by the amount of mortar necessary for placement, which must be high.

Steel sand. Here the specific gravity is 6.6 to 7.6. Steel in sand sizes as mixed in the laboratory has given every indication of being much more suitable than punchings, in so far as placeability and uniformity are concerned. The cost is about the same as for punchings. Steel sand from Long Island City, as well as crushed cast-iron shot from England was used in these investigations.

Ferrophosphorus. This is an extremely heavy material having a specific gravity of about 6.0. With it, concrete weighing 300 lb per cu ft was easily made. The material used in this laboratory had two drawbacks:

First, it was very expensive, and second, concrete made with it remained "green" and weak for several weeks before gaining much strength. This slow setting was attributed to the presence of sulfur in the aggregate, but this was not completely verified. The high cost of such concrete has interfered with the use of this aggregate to such an extent that an exhaustive investigation of it was not deemed advisable.

Boron additives. In some instances boron additives are desirable for decelerating neutrons. This material is especially graded from ⅛ in. to 30 mesh and has a specific gravity of about 2.40. Since this is lighter than conventional concrete aggregates, compensation must be provided for this differential.

Combinations of these materials or their combination with standard concrete aggregates provide the desired weights for particular specification requirements. In determining combinations, it is advisable that the specific gravities of all the coarse aggregates used be reasonably close; when possible all the aggregates should have a uniform specific gravity.

Steel punchings combined with limonite or a lighter aggregate have a tendency to segregate and sink when placed and vibrated. Gravel combined with magnetite or ilmenite will "float." The result is an unbalanced mixture in place, and radiation leaks are to be expected.

Problems arose in the proportioning of mixtures as a result of poor gradation, the angularity of the fine aggregate, and the necessity of combining two or more aggregates to obtain a specific weight. To meet these difficulties, it was necessary to:

1. Establish a minimum average specific gravity for the total aggregate to obtain any particular concrete weight.
2. Determine the minimum amount of fine mortar needed for placeability.
3. Determine the minimum amount of material passing the No. 8 or No. 6 sieve for total mortar.

First the amount of water for various sizes of aggregate was estimated from Fig. 1. Next the amount of cement and material passing the No. 50 screen to provide minimum lubricating value was determined. The total amount of cement and fine aggregate passing the No. 8 or the No. 6 screen for the minimum mortar content was found from charts shown as Figs. 2 and 3.

The formula used for combining two aggregates of different weights was:

$$\frac{A\ (X - B)}{X\ (A - B)} = \%\ \text{of}\ A$$

in which:

X = desired specific gravity of total aggregate

A = specific gravity of heaviest aggregate

B = specific gravity of lightest aggregate

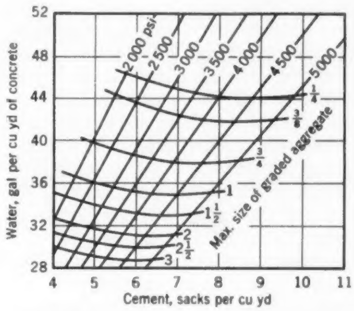


FIG. 1. Water requirements for job mixes, per cubic yard of concrete, using crushed aggregate only, are shown by this chart.

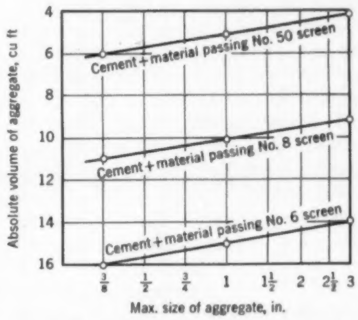


FIG. 3. Minimum amounts of fine "workability" mortar and total amounts of mortar for "placeability" can be found from this chart.

FIG. 2. Minimum amounts of cement and percentages of total aggregate passing the No. 50 screen, for various strengths of concrete, can be determined from chart.

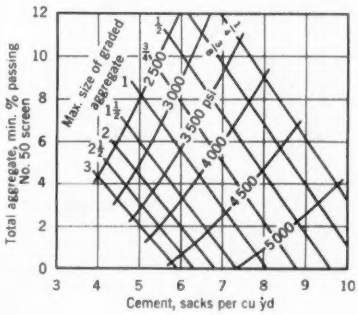
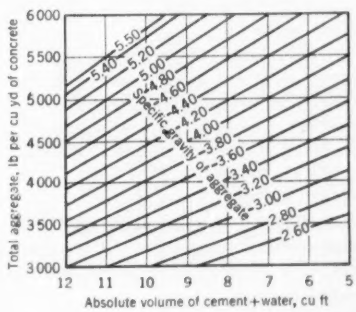


FIG. 4. Absolute volumes of cement and water required for aggregates of various specific gravities, per cubic yard of concrete, are indicated by these curves.



Job Problems

The job problems encountered are not especially greater than those for conventional concrete, but should be given more careful consideration. Closer inspection is needed. Listed below are the important items to be considered in making dependable heavy-weight concrete.

1. Cement. A great deal of the cement now being manufactured contains varying amounts of air-entraining agents regardless of how it is sold. A careful check of each shipment is advisable to prevent unexpected weight losses. An air-detraining agent would be the logical answer to this problem.

2. Specific gravity. When combining two or more aggregates of different specific gravities, every effort should be made to use aggregates with specific gravities as nearly uniform as possible. When this is not possible, the proportions should provide a minimum amount of mortar, and concrete made with a stiff consistency.

3. Contamination of aggregate. There must be no contamination of the stock piles with other aggregates.

4. Human factor. Some provision should be made for allaying the apprehensions of those who handle this material for the first time. The sight of a stock pile of 3-in. ore is often discouraging to the uninitiated.

5. Mixer loading. Loads must be reduced as much as 50 percent, depending on the weight of the concrete being mixed.

6. Mixing water. Use a minimum amount of mixing water. Slump tests are not always practical but what might be called a slump equivalent of 3 in. or less should be used if possible to minimize bleeding and segregation.

7. Retarding agent. Use a *non-air-entraining, retarding* agent to reduce water content, particularly during hot or even warm weather.

8. Placeability. Placeability is much more descriptive of this concrete than workability because of its weight and the angularity of the fine aggregate particles. The standard rules for placing conventional concrete in layers (not always followed) are a "must" for heavy concrete.

9. Vibration. It is advisable to have several replacement vibrators on hand. If the vibrator head is allowed to go a little too deep, a lost vibrator is often the result. Vibration must be sufficient to effect maximum compaction but without excess.

10. No air entrainment. Be sure there is no air entrainment. It counteracts the effect of the heavy-weight material.

ENGINEERS' NOTEBOOK

Moment distribution factors for tapered members

THOMAS D. Y. FOK, M. ASCE, Associate Professor of Engineering

The Youngstown University, Youngstown, Ohio

Tapered structural members of rectangular cross-section are often used in concrete structures, for example, as supporting legs for viaducts on expressways. Charts for determining the moment distribution factors for this type of member are found in the Portland Cement Association's *Handbook of Frame Constants,* and in many textbooks on statically indeterminate structures.

However, these charts have limitations in actual application. The proportions of a structural member may be such that it lies outside the range of these charts. Even if the member lies within the limits of the charts, interpolation may be required and this is not always satisfactory because the stiffness factor of such a member is very sensitive to a small change in dimensions.

Following the principles used in constructing the design charts, general formulas for computing carry-over factors, stiffness factors and fixed-end moments due to support movements are here derived for tapered members of rectangular cross-section. The equations can be programmed for electronic computers.

In Fig. 1, the dimensional nomenclature is given for tapered members whose faces have slopes of $s_1 = ra/(2L)$ and $s_2 = qb/(2L)$. Let the constants C_1, C_2, C_3, C_4 and D be so defined that

$$C_1 = \frac{r^2 + 2q + rq}{2\,(r-q)^2\,(1+r)^2}$$

$$C_2 = \frac{q - 3r - 2}{2\,(r-q)^2\,(1+r)^2}$$

$$C_3 = \frac{r + 2 + q}{2\,(r-q)^2\,(1+r)}$$

$$C_4 = \frac{r - 2 - 3q}{2\,(r-q)^2\,(1+r)}$$

$$D = \frac{\log_e (1+r) - \log_e (1+q)}{(r-q)^3}$$

Then, the moment distribution factors

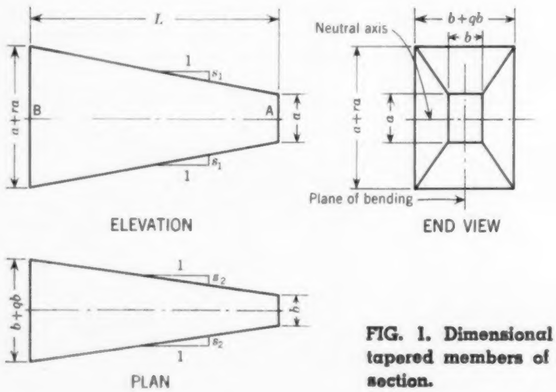


FIG. 1. Dimensional nomenclature for tapered members of rectangular cross-section.

based on the designer's sign convention can be obtained as follows.

1. Carry-over factors. Note that the signs for C_{AB} and C_{BA} should be negative. Their values are:

$$C_{AB} = -\frac{(C_1 - C_2) - (q+1)D}{C_2 + D}$$

$$C_{BA} = -\frac{C_3 - (q+1)D}{C_4 + (q+1)^2 D}$$

2. Stiffness factors. Let $I_c = ba^3)/12$, and express the stiffness, $S = (k\,EI_c)/L$. For members AB fixed at both ends,

$$S_{AB} = (k_{AB}EI_c)/L, \text{ and}$$

$$S_{BA} = (k_{BA}EI_c)/L$$

for which

$$k_{AB} = \frac{1}{[C_4 + (q+1)^2 D] + C_{AB}[C_3 - (q+1)D]}$$

$$k_{BA} = \frac{1}{[C_2 + D] + C_{BA}[C_3 - (q+1)D]}$$

For members with one end hinged, the modified stiffness S' at the fixed end is given by $S' = S\,(1 - C_{AB}C_{BA})$ (See *Statically Indeterminate Structures*, by C. K. Wang, pp. 282–283.)

3. Fixed-end moments due to lateral displacement. Let the lateral displacement of the fixed-end member be Δ, and let $R = \Delta/L$. The fixed-end moment due to Δ (See Wang, above) becomes:

$$M_{AB} = S_{AB}\,(1 + C_{AB})\,R$$

$$M_{BA} = S_{BA}\,(1 + C_{BA})\,R$$

For the special case for which $r = q$, these factors can be reduced to a very simple form:

1. Carry-over factors

$$C_{AB} = -\left[\frac{1+r}{2}\right],$$

$$C_{BA} = -\left[\frac{1}{2\,(1+r)}\right]$$

2. Stiffness factor

$$k_{AB} = 4\,(1+r),\ k_{BA} = 4\,(1+r)^3$$

$$S = k\,EI_c/L, \quad S' = 3\,S/4$$

3. Fixed-end moments due to lateral displacement

$$M_{AB} = 2\,(1+r)\,(3+r)\,R\,EI_c/L.$$

$$M_{BA} = 2\,(1+r)^2\,(3+r)\,R\,EI_c/L.$$

Two numerical examples are given to illustrate the use of the formulas. It is necessary to mention only that the formulas for carry-over factors involve the difference of two large numbers of the same order of magnitude. To obtain three significant figures in the final results, six or seven figures should be used for computing the constants. This explains why extrapolation from design charts is not always satisfactory.

Example 1. For member AB, fixed at both ends, $L = 30$ ft, $a = 3$ ft, $b = 2$ ft, $r = 1$, $q = 0.6$, and $E = 3 \times 10^3$ ksi. Then, $I_c = 4.5$ ft^4, $S_1 = 1/20$, $S_2 = 1/50$.

Then, by substitution in the formulas:

$C_{AB} = -0.841$ $\qquad$ $C_{BA} = -0.294$

$k_{AB} = 6.75$ $\qquad$ $k_{BA} = 19.4$

$S_{AB} = 438{,}000$ kip-ft per radian

$S_{BA} = 1{,}260{,}000$ kip-ft per radian

Example 2. Here again, member AB is fixed at both ends and $L = 30$ ft, $a = 3$ ft, $b = 2$ ft. In this case however, $r = q = 1$. As in Example 1, $E = 3 \times 10^3$ ksi; $I_c = 4.5$ ft^4; $S_1 = 1/20$; and $S_2 = 1/50$.

Again by substitution,

$C_{AB} = -1.0$ $\qquad$ $C_{BA} = -0.25$

$k_{AB} = 8.0$ $\qquad$ $k_{BA} = 32.0$

$S_{AB} = 520{,}000$ kip-ft per radian

$S_{BA} = 2{,}080{,}000$ kip-ft per radian

Shielding properties of concrete

FRANK TITUS, Department of Physics, Dartmouth College, Hanover, N. H.

A study of the penetration in concrete of gamma radiation from fallout has been conducted by the National Bureau of Standards for the Civil Effects Test Group of the Atomic Energy Commission. Measurements were made after two detonations at the Nevada Proving Grounds, providing on-the-scene experimental data on the effects of fallout. Results of this study can be directly compared with established theory and are therefore extremely important in the development of suitable shelters against radiation from nuclear weapons.

This study, made by the writer when he was a member of the Bureau's radiation theory group, is one of the first attempts to make field measurements of fallout in arrangements that lend themselves to a theoretical approach. By allowing an adequate comparison between experimental data and theoretical calculations, this work provides a basis for extending theory to configurations more elaborate than those for which predictions are now possible.

A central problem of radiation shielding is the prediction or estimation of radiation effects at each point within a shielding structure. This problem has often been attacked by building the structure of interest and measuring the radiation penetrating to its interior. These tests have provided the answer to specific shielding questions in complicated configurations only, and it was not possible to extrapolate their results to different conditions.

As the propagation of radiation depends in part on the geometry of the medium, a simple construction would yield results more widely applicable and more easily interpreted. For these reasons, the Bureau chose as its test geometry an infinite plane uniformly covered by fallout. A calculation of the penetration for this simplified situation, which is in effect a semi-infinite homogeneous medium exposed to a plane-isotropic source, had previously been worked out by the radiation theory group. This calculation formed the theoretical basis with which experimental results were compared.

Concrete, one of the materials most suitable for large-scale shielding applications, was the medium chosen for study. Penetration was experimentally determined in a stack of seven reinforced concrete slabs, each 6 ft square by 3.2 in. thick. They were positioned in a pit with the top of the stack at ground level. Geiger counters inserted into spaces between the slabs measured the dose rate as a function of depth. The total dose accumulated at each level was monitored by pocket or film dosimeters. In addition to the detectors

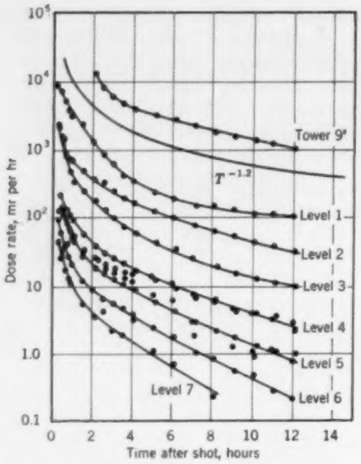


Fig. 1. Decrease in dose rate with time is shown on tower 9 ft above ground and at seven levels within a concrete mass, represented by a stack of seven reinforced concrete slabs positioned in a pit with the top at ground level.

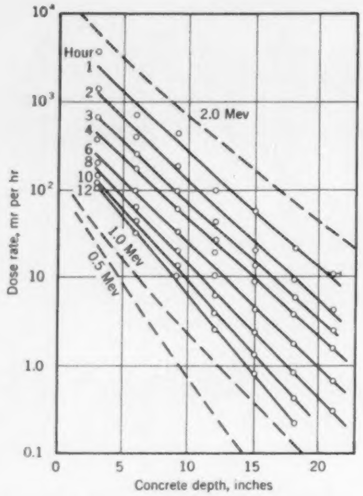


FIG. 2. Fallout gamma penetration at selected times, in hours, after detonation is compared with the penetration of monochromatic-plane isotropic gamma sources. Early the penetration is like a 2-Mev source, later like a 1-Mev source.

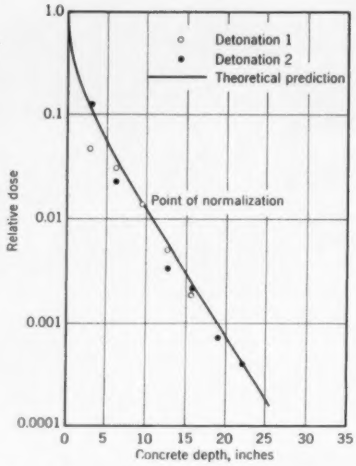


FIG. 3. Experimental pentration one hour after detonation (normalized to calculated curve at a depth of 9.5 in.) shows good agreement with theory based on the fission gamma spectrum one hour after fission.

within the concrete mass, detectors were mounted on a steel tower 20 ft from the pit.

The detection system was a remote radiation monitoring system designed by the Bureau. Dose-rate detectors were connected with equipment in nearby underground vaults. From these underground stations, data were transmitted by direct field lines to a control point where information was automatically checked and catalogued.

Experimental data were obtained in this way after each of two nuclear explosions. Immediately after the test shot, dose rates were measured in the various levels of the concrete and at the tower. The measurements were repeated at frequent intervals, until the dose rates in the lower levels were below 1 mr (milliroentgen) per hour. These measurements were performed at 2,000 yd from one nuclear test shot and 4,000 yd from the other. Typical results are presented in the curves of Fig. 1.

Results of this work indicate that the time dependence of the dose rate above ground is $t^{-1.2}$, which is in agreement with precise dose-decay measurements made after many other shots. The fallout incident on the concrete may therefore be considered typical. The dose rate under 9 in. or more of concrete decreases more rapidly with time than the surface dose rate during the first 10 or 12 hours after the blast. This decrease is probably due to the rapid decay of the more penetrating, higher-energy components of the gamma spectrum at the surface.

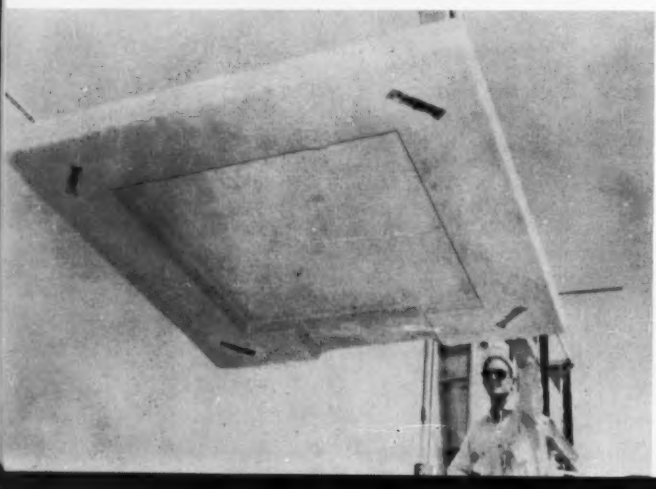
The penetration of fallout gamma radiation at various times after a shot is illustrated in Fig. 2. Figure 3 compares the measured penetration with a more exact theoretical calculation based on the presumed fallout gamma spectrum.

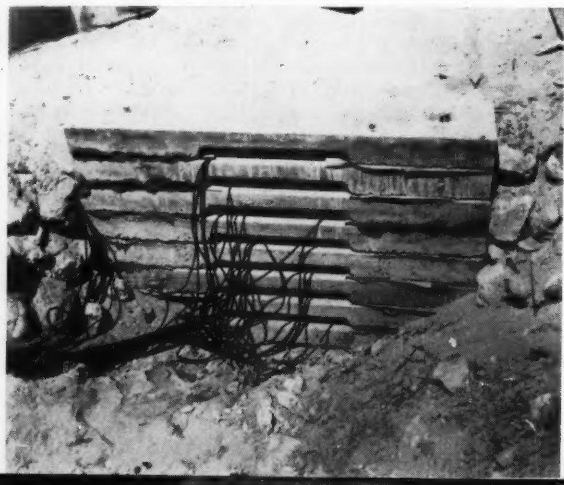
During the first few hours, the penetration of fallout radiation is very like that of a 2-Mev (million electron volts) plane isotropic gamma source. At a later time, penetration falls off, resembling a 1-Mev plane isotropic source.

At almost all times the dose rate under 3 in. of concrete was found to be approximately 1/10 that at 9 ft above the ground. Each additional 6 in. of concrete reduced the dose rate by another factor of approximately 1/10. The dose rate under 22 in. of concrete is therefore approximately one ten-thousandth of the dose rate at 9 ft above the ground. This experimentally observed decrease in dose rate with depth shows good agreement with the calculated decrease in dose rate for an ideal situation.

In preparing this article, free use was made of a release from the National Bureau of Standards.

Gamma-ray fallout from nuclear detonations was measured in a stack of seven slabs, one of which is seen at left, below. Stack was wired (right) to connect detectors to monitoring equipment in an underground vault.





AMERICAN SOCIETY OF CIVIL ENGINEERS

Sanitary Engineering Division Conference

The Economics of Pollution Abatement

Hotel Netherland-Hilton, Cincinnati, Ohio **January 6, 7, and 8, 1960**

WEDNESDAY MORNING

JAN. 6

9:00-10:00 Registration, in Fourth Floor Foyer

Session Chairman: Arthur D. Caster, Conference Chairman

10:00 Greetings from the City of Cincinnati

10:15 Our Natural Resources

HON. ROBERT S. KERR, Senator from Oklahoma.

10:45 Environment and Health—New Challenges

MARK D. HOLLIS, Asst. Surgeon General, U. S. Public Health Service, Washington, D. C.

WEDNESDAY AFTERNOON

JAN. 6

2:00 p.m.

Air Pollution

Session Chairman: Lewis A. Young, Chairman, Executive Committee, Sanitary Division

Moderator: Vernon G. MacKenzie, Asst. Chief, Research and Development, Div. of Sanitary Engineering Service, U. S. Public Health Service

1. Status of Air Sanitation Activities in the United States

   RICHARD E. HATCHARD, Chief, Air Pollution Control, Oregon State Board of Health.

2. Air Pollution as a Sanitary Engineer's Problem

   WILLIAM T. INGRAM, Consulting Engineer, New York, N. Y.

3. Cincinnati as an Air Pollution Research Center

   HARRY G. HANSON, Director, Robert A. Taft Sanitary Eng. Center.

COMMITTEE

Arthur D. Caster, *General Chairman*

Bernard B. Berger, *Assistant Chairman*

Hayse H. Black, *Local Arrangements*

THURSDAY MORNING

JAN. 7

9:00 a.m.

Land Pollution

Session Chairman: Ray Lawrence, Past Chairman, Executive Committee, Sanitary Engineering Div.

Moderator: M. H. Klegerman, Consulting Engineer, Alexander Potter Associates, New York, N. Y.

1. Refuse Disposal in Three Dimensions

   F. R. BOWERMAN, Asst. Chief Engineer, County Sanitation Districts of Los Angeles County.

2. The Impact of Rigid Air-Pollution Criteria on Refuse Disposal

   WILLIAM A. XANTEN, Supt., Div. of Sanitation, Government of District of Columbia, Washington, D. C.

3. Refuse and Land Reclamation—Its Engineering Aspects

   LEO WEAVER, Director of Engineering, Dept. of Sanitation, New York, N. Y.

4. Trends in the Design and Operation of Municipal Incinerators

   CASIMIR A. ROGUS, Director of Engineering, City Dept. of Sanitation, New York, N. Y.

THURSDAY AFTERNOON

JAN. 7

2:00 p.m.

Water Pollution

Session Chairman: Bernard B. Berger, Asst. Conference Chairman

Moderator: Gordon E. McCallum, Chief, Div. of Water Supply and Water Pollution Control Prog., U. S. Public Health Service

1. Water Resources of the United States

   WILLIAM C. ACKERMANN, Chief, State Water Survey, Urbana, Ill.

2. Water Quality

   GERARD A. ROHLICH, Prof. of Civil Engineering, Univ. of Wisconsin, Madison, Wis.

3. Supplementation of Water Resources

   LOUIS KOENIG, Research Consultant, San Antonio, Tex.

BANQUET

Thursday, Jan. 7

6:30-7:00 p.m. Fellowship time

Courtesy of friends of the Cincinnati Section of ASCE.

7:00 p.m. Banquet

8:00 p.m. Address: What Can Our Culture Afford?

ARTHUR FLEMMING, Secretary, Dept. of Health, Education and Welfare, Washington, D. C.

FRIDAY MORNING

JAN. 8

9:00 a.m.

Session Chairman: Edward J. Cleary, Executive Director and Chief Engineer, Ohio River Valley Water Sanitation Commission, Cincinnati, Ohio

1. ASCE and the Future

   WILLIAM H. WISELY, Executive Secretary, ASCE, New York, N. Y.

2. Conference Summation

   ABEL WOLMAN, Prof. of Sanitary Engineering, Johns Hopkins Univ., Baltimore, Md.

FRIDAY TOURS

1:15 p.m. Buses leave for tours.

Tour 1

Air Pollution and Water Pollution Research Laboratories at the Robert A. Taft Sanitary Engineering Center will be inspected.

Tour 2

The 120-mgd Mill Creek Sewage Plant and the Administrative Offices, including the Industrial Waste Labs, will be inspected.

SOCIETY NEWS

MERRY CHRISTMAS *HAPPY NEW YEAR*

Campaign for Funds for UEC Continues

It was just two years ago this fall, November 21, 1957, that the campaign for funds for the United Engineering Center was launched. The industrial campaign, with $5 million as its goal and Mervin J. Kelly as general chairman, has now realized $4,677,252 from 525 contributors. The member gifts campaign, with a goal of $3 million and ASCE Past-President R. E. Dougherty as general chairman, now has $2,761,387 in pledges from 59,795 contributors.

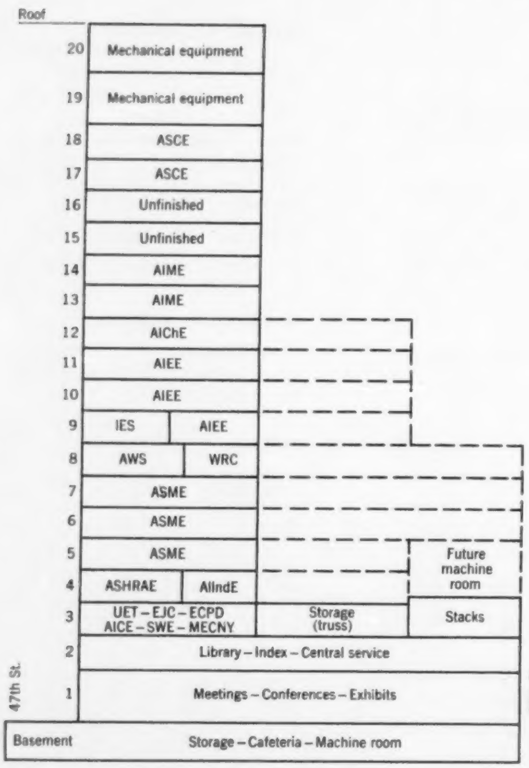
ASCE, which was a little slow in getting its drive launched, is now going full speed ahead and currently has collected 81 percent of its allotted quota of $800,000. ASCE Past-President Francis Friel dedicated his year in office to pushing the campaign, with the result that almost a half-million dollars was contributed during his term. With October a $50,000 month, we are now (November 13) but $158,000 from final success.

This success, Executive Secretary Wisely reminds Local Section officers and fund-raising personnel in his monthly report on the campaign, "will take hard work in every Local Section." Said Mr. Wisely:

"Realizing that the road to the ASCE quota is paved by the quotas of the Local Sections, the Metropolitan ($119,200), Tennessee Valley ($9,200), Connecticut ($11,000), Maine ($4,700) and Rhode Island ($2,900) Sections have now taken their places on the Honor Roll of 100 percenters. The total of local quotas fulfilled is now 27, just past a third of the total of 78 Sections.

"The last 20 percent of the campaign will be the hardest part yet. Now is the time for stern measures, as in the Alaska Section, which has voted $1,000 from its own treasury so as to give final impetus to its drive. Take another look at your roster and seek out any 'blue ribbon' prospects who have yet to do their part.

"Success is within reach. Let's put on the pressure and get the job done!"



This elevation of the United Engineering Center shows who will be where when the new 18-story headquarters is ready for occupancy in mid-1961. Groundbreaking for the new structure — a slim tower of glass, metal, and limestone rising from a two-story base — took place on October 1. Dotted lines indicate future construction.

Steel Contract Let

A contract for fabrication and erection of 3,300 tons of structural steel for the United Engineering Center has been given to the Dreier Structural Steel Co., of Long Island City, N. Y., whose plant is just across the East River from the new building. This firm has commitments for delivery that, it is hoped, will assure steel for the new headquarters for engineers even if a strike is called after the present 80-day resumption of production. The arrangements were made through the Turner Construction Co., general contractors, who are now completing major agreements to give the UET Trustees a firm figure for construction.

UEC HONOR ROLL

Three New England Sections—Connecticut, Maine, and Rhode Island—have achieved the Honor Roll since the listing last appeared (November issue). Once again we list the successful Sections—twenty-seven of them now—in the order in which quotas were met. Percentages are as of November 13.

Kentucky (122)
Lehigh Valley (141)
Nashville (103)
Cincinnati (141)
Columbia (130)

Philadelphia (143)
Hawaii (119)
Rochester (123)
Ithaca (121)
Southern Idaho (166)
Indiana (137)
Delaware (105)
Kansas City (109)
Central Pennsylvania (108)
Arizona (108)
West Virginia (124)
Central Ohio (103)
Tri-City (110)
Puerto Rico (115)
Wisconsin (103)
Georgia (104)
Maryland (104)
Tennessee Valley (104)
Metropolitan (105)
Connecticut (102)
Maine (100)
Rhode Island (100)

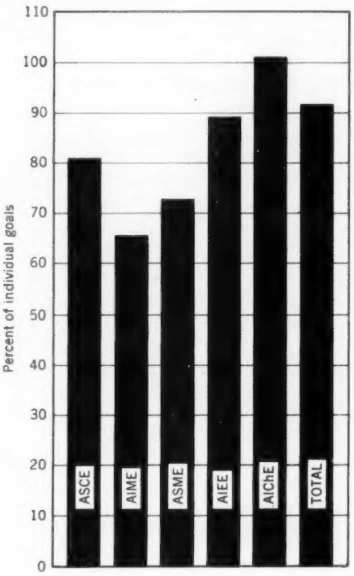


Fig. 1. **Member giving for United Engineering Center as of November 13. ASCE, with a $50,000 October behind it, has subscribed 81 percent of its quota.**

Campaign in ASCE Sections

Local Section	Quota %	Local Section	Quota %
The Champs!			
South Idaho	166	Arizona	108
Philadelphia	143	Central Pa.	108
Cincinnati	141	Delaware	105
Indiana	137	Maryland	105
Lehigh Valley	136	Metropolitan	105
Columbia	130	Georgia	104
West Virginia	124	Tenn. Valley	104
Rochester	123	Central Ohio	103
Kentucky	122	Nashville	103
Ithaca	121	Wisconsin	103
Hawaii	119	Connecticut	102
Puerto Rico	115	Maine	100
Tri City	110	Rhode Island	100
Kansas City	109		
Down the Stretch			
Nebraska	95	Texas	79
Syracuse	95	Sacramento	74
Iowa	94	Panama	72
San Francisco	91	St. Louis	72
Illinois	89	Seattle	71
Central Illinois	88	Spokane	71
Tacoma	85	Kansas	70
Massachusetts	81	Mid-Missouri	70
Gaining Speed			
Buffalo	68	Toledo	51
Duluth	68	Montana	50
Oklahoma	68	South Carolina	50
Pittsburgh	68	Nat'l. Capital	49
Dayton	63	Virginia	49
Cleveland	61	Intermountain	47
North Carolina	61	Venezuela	47
Mid South	60	Oregon	46
Akron	57	Miami	45
Mohawk-Hudson	56	Alaska	44
San Diego	52	New Mexico	42
Los Angeles	51		
Slow Start, Strong Finish?			
Northwestern	39	Wyoming	30
Michigan	37	Florida	29
Mexico	36	South Dakota	28
Louisiana	35	Alabama	26
Colorado	34	Brazil	14
New Hampshire	32	Rep. Colombia	10

EJC Launches Newsletter

Where is the engineering profession headed? What is happening on Capitol Hill that will affect engineers? And what of events abroad that will affect them? Should engineering curricula be overhauled? And what is going on in the fields of research and development? These are some of the areas in which Engineers Joint Council will provide information in *Engineer,* its recently launched newsletter. The new publication will be issued periodically.

In addition to covering inter-Society activities of mutual interest and concern, *Engineer* will provide a quick run-down of events—legislative, administrative, legal, national, and international—that are important to the engineer. It will alert him to forthcoming EJC reports in such areas as manpower, engineering salaries, engineering education, and military service for trained personnel. There is a calendar of forthcoming meetings, a section on education, a picture of current research, a listing of EJC publications, and a bibliography of scientific reports of interest. There is even an occasional light touch.

Copies of *Engineer* are being mailed to Local Section officers, members of the Board of Direction, members of the Committee on Conditions of Practice, and editors of Local Section newsletters. Free subscriptions are available to all other members of ASCE, and to the membership of the other constituent EJC societies. Request should be made to Engineers Joint Council, 29 West 39th Street, New York 18, N. Y.

In the foreword to the first issue, EJC President Enoch R. Needles says that "*Engineer* will be the means eventually of giving word to all engineers everywhere of the steady advancement of the profession." He notes that "EJC provides a meeting place for all the Societies to debate and act on common problems of importance, to the advantage of all. EJC is truly a Council, just as is the Engineers Council for Professional Development. The strength of both lies in the fact that they are Councils of Society representatives, supplementing each other and designed for specific purposes of common import."

Twenty-one engineering societies, with a combined membership of 300,000, are currently represented in EJC.

Metropolitan Section to Form Guide Committee

With engineers from all over the world beating a path to New York these days, the Metropolitan Section has come up with a very sound idea for making them feel at home and helping them see the city. The idea is a volunteer Guide Committee, made up of Section members, to escort the engineer tourists about the city. Upon occasion the committee might include the engineers responsible for design or construction of the projects to be visited. In fact, committee members might be able to arrange visits to projects not otherwise accessible to the public.

To find how much interest there would be in such a committee the Section is asking 75 organizations that may be sponsoring visits of engineers to the city during the next year to return a questionnaire to Society headquarters. On it they will indicate roughly how many will come and the works in which they would most likely be interested. Interest shown in the plan will be a factor in determining the extent of the Guide Committee's operations. The groups queried include U. N. missions, embassies, and engineering societies.

Says A. E. Dembitz, chairman of the Section's Public Relations Committee, "The Guide Committee's services would be offered as a professional courtesy, for it is one of the basic tenets of ASCE that today's experiences and achievements (and failures) be made available to other engineers and to future generations. The Guide Committee would not accept any remuneration. By the same token, it is not anticipated that the committee members would be responsible for transportation, admission fees, or any other expenses."

Research Opportunities Studied at ASCE Conference

That civil engineers are becoming more conscious of research opportunities was a general conclusion of the Second ASCE Research Conference. Another general conclusion was that someone ought to do something about it. Thirty members of the Society spent two days in conference and two additional days in committee meetings, attempting to bring these generalities closer to specifics.

The two-day conference took place this fall at Northwestern University. It was organized by the Research Committee of ASCE, with the cooperation of Northwestern University and the research committees of the Society's Technical Divisions. In the opinion of the Research Committee, the conference made it possible to progress somewhat beyond the stage of "we need more research in civil engineering," and to deal with more specific analysis of projects, definition of objectives, promotion of support, organization to accomplish such activities, and general financing of such research efforts. At the same time, there were still some remnants of the belief that widespread expenditure of funds will in itself solve some research needs.

Three Types of Research Needed

In his report to the Board of Direction about the conference, Chairman Arthur T. Ippen listed three areas in which new research is needed: (1) development of new principles; (2) adaptation of principles to the practice of engineering; and (3) synthesis of engineering, human, and economic factors. Dr. Ippen reported that his committee was of the opinion that many industries which are related closely to civil engineering display a definite lack of interest in research. It was the conclusion of the committee that ASCE must, as an organization, establish procedures which will improve attitudes and produce new work.

One type of organization suggested was the proved scheme of research councils. In these councils general areas of concern are studied by informed representatives of the various segments of engineering involved, and new research is planned, organized, and financed. Continuation of the work of the Technical Divisions, many of which operate research committees, was urged. Dr. Ippen reported the need to tap available sources of funds to finance the necessary effort. Three proved sources of funds named were industry, private foundations, and government.

Conference Speakers Analytical

In an attempt to get to the point rapidly, the conference was organized around a number of prepared talks. A record of these papers will be published separately. As a start, Dr. Ippen reviewed the efforts of his Committee on Research, and gave a general picture of research activities in civil engineering. He was followed by Dean John S. McNown, representing the Engineering Mechanics Division, who described the nature of research to be supported by ASCE activities. In the discussion of Dr. McNown's remarks, it was pointed out that the professional status of civil engineers does not permit them to confess openly that there are some things they do not know. There is often the pressure to "get the job done" even if there are some uncertainties that have to be ignored in the process. As a start, it is necessary to confess the "need to know" and to define areas in which intellect, effort, and money must be expended to improve the usefulness of civil engineering.

Specific examples of the type of research which needs to be organized and supported were given by Prof. James M. Robertson, representing the Hydraulics Division. The reaction of industry to such research activities was described by William W. Moore, who represented the Construction Division at the conference. Both dollarwise and interestwise, the impact of government upon research could not be forgotten, even for a moment. Such interest was described in a paper prepared by Public Roads Commissioner Ellis L. Armstrong, representing the Highway Division, and presented by O. K. Norman, also of the Bureau of Public Roads.

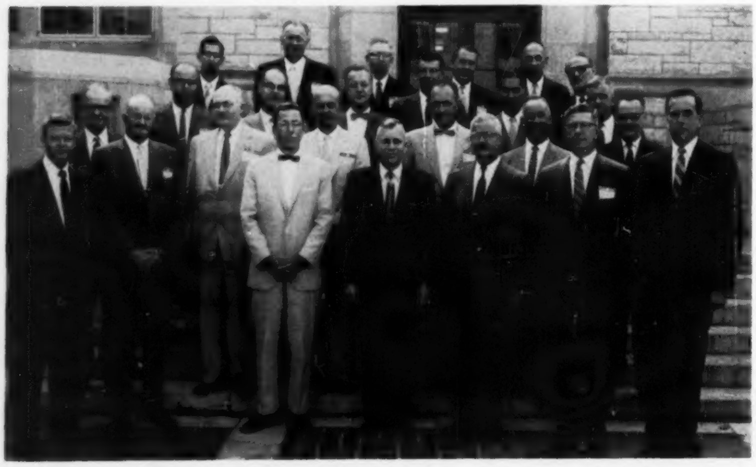
ASCE Organization Examined

Because many problems yield to good organization, the men assembled in Evanston referred constantly to organized efforts within the Society, and within other organizations of the profession, to expand the research consciousness of civil engineers. Dr. Nelson L. Nemerow, representing the Sanitary Engineering Division, and Dr. Thomas C. Kavanagh, representing the Structural Division, presented specific proposals for new and stronger organization, which would bring together some of the best minds and focus their concern for research.

Because all such activities require dollars as well as minds, Dr. Kavanagh indicated ways in which such an organization could logically obtain the support of industry. This theme was elaborated by Marcel P. Aillery, representing the Power Division, who gave specific examples of industry's support of research.

The proper approach to draining funds from the huge reservoirs of the private foundations was described in a paper prepared by Maurice L. Albertson, representing the Irrigation and Drainage Division, and presented by Robert L. Hardman. Dr. Ippen described procedures for obtaining financing for research from government agencies.

The conference built upon conclusions of a first Conference on Basic Research, which was held approximately a year ago under sponsorship of the ASCE Research Committee, with the National Science Foundation and George Washington University. These conferences were viewed, by the Research Committee, as an attempt to bring about the "research mindedness" that is deemed an important quality for the civil engineer.



Research Committees of the Technical Divisions were represented at Northwestern University Conference conducted by the ASCE Research Committee.

ASCE New Orleans Convention Is Next

Scene is the Washington Convention, but talk is of New Orleans, which will be host to the ASCE Spring Convention, March 7-11. Bernhard Dornblatt (left), new Director for District 15, tells ASCE President Frank Marston and Executive Secretary W. H. Wisely of plans being made to interest and entertain Convention visitors. The committees of Louisiana Section members will be headed by Roy T. Sessums. There will be a story about the New Orleans Convention in the January issue and the complete program in February.

Registration and ASCE Membership—Signs of Status

In the featured talk at one of the Washington Convention luncheons, Lt. Gen. Emerson C. Itschner, F. ASCE, Army Chief of Engineers, called registration and Society participation "signs of professional status."

"Even though professional registration is not a prerequisite for employment as an engineer by the Corps of Engineers and has no official influence over career development of either the engineer officer or civilian engineer," he told ASCE members, "it is my policy to encourage registration and to foster it to the utmost. I do this for several good reasons.

"Registration reflects an element of professional prestige that encourages a man to do his best work. It gives him a sense of responsibility to inspire and guide him. It gives him a mark of stature among other members of the profession that can be gained by no other means. It gives him personal satisfaction in the practice of his profession that comprises one of its inherent rewards. In sum total, it makes him a better engineer—it requires him to measure up."

"As a matter of policy, I encourage our personnel to join and participate actively in professional engineering societies. Authorization for attendance at meetings of such societies as a matter of official duty is designed to encourage such participation. Authority for travel to a meeting is granted on the basis that the individual must serve as an officer, or an active member of a committee or group participating in the program of such a meeting, or personally present or discuss a paper or a subject related to his duty. Corps representation is rotated to promote the maximum participation of qualified personnel. Personnel who do not qualify for authorized attendance as a matter of official duty will find the Corps liberal in the granting of leave for professional meeting attendance."

General Itschner concluded, "I believe that every professional engineer in the Corps should be a member of and actively support the engineering society appropriate to his field. He will be a much better engineer and a more valuable employee for doing so."

SOCIETY AWARDS AND FELLOWSHIPS AVAILABLE

DANIEL W. MEAD PRIZES:	*1960 contest closes May 1, 1960. See 1959 Official Register, page 143, and July 1959 issue of CIVIL ENGINEERING, page 66.*
FREEMAN FELLOWSHIP:	*1960 contest closes April 15, 1960. See Official Register, page 154.*
ERNEST E. HOWARD AWARD:	*Closing date Feb. 1, 1960. See Official Register, page 142.*
ASCE RESEARCH FELLOWSHIP:	*1960 contest closes January 1, 1960. See Official Register, page 156.*
J. WALDO SMITH HYDRAULIC FELLOWSHIP:	*1961-62 (closing date pending). See Official Register, page 156.*

ASCE Membership as of November 9, 1959

Fellows	10,872
Members	15,623
Associate Members	17,518
Affiliates	91
Honorary Members	47
Total	44,151
(November 10, 1958	42,168)

Papers from Intersociety Conference on Irrigation

The wise use of water is the subject of the Proceedings of the First Intersociety Conference on Irrigation and Drainage recently announced by the U.S. National Committee of the International Commission on Irrigation and Drainage. The Proceedings are the result of an initial attempt to bring together information from professional groups—engineers, irrigationists, soil and plant scientists, lawyers, plant pathologists, entomologists, and botanists—who met in San Francisco in 1957 to study the theme, "Can Man Develop a Permanent Irrigation Agriculture?"

Conference sponsors were the Irrigation and Drainage Division of ASCE, the American Society of Agricultural Engineers, and the Soil Science Society of America, in cooperation with the U.S. National Committee.

Conference speakers agreed that man can develop a permanent irrigation agriculture—if he acquires a thorough knowledge of his environment and uses the knowledge wisely. Conference papers discuss the problems that must be solved in proper development and utilization of our water resources.

The Proceedings, priced at $4.50 a copy, may be purchased from the U.S. National Committee, International Commission on Irrigation and Drainage, Post Office Box 7826, Denver 15, Colo.

Electric Computer Applications

The following descriptions of applications of electronic computers to the solution of civil engineering problems have been prepared from information assembled by the Task Committee on Program Directory and Library of the Structural Division Committee on Electronic Computation.

To assist this Task Committee in its aim of assembling a comprehensive directory of computer applications in the structural engineering field, readers are invited to send information to: John J. Kozak, ASCE Task Committee, P.O. Box 1499, Sacramento 7, Calif.

It is felt that the publication of these brief descriptions in Civil Engineering will give civil engineers a better understanding of the capabilites of modern computers. It is furthermore believed that engineers working closely with computers will profit from seeing what has been programmed on computers other than their own. Civil Engineering is not attempting to set up an exchange program but rather to present this information for the general benefit of its readers. The editors will appreciate comment from members regarding the frequent publication of these descriptions.

Program St. 1: Determinate Truss Analysis

Equipment: Basic IBM 650

Programmed by: University of Houston Computing and Data Processing Center, Houston, Tex.

Purpose: To compute and report the axial stresses in a simple, statically determinate, pin-connected truss. The answer cards are presented in a form which can be used in a subsequent program to compute redundants.

Limitations: Maximum numbers of members 99; maximum number of joints 99; maximum number of loads 19; maximum number of members meeting at a joint 9; maximum axial force 9999.9.

Input-Output: Input consists of the cordinates of the truss joints, the joints at which each member ends, and the loads to be applied.
The output is the axial force in each member and the reactions. The output cards serve as input for a program to compute redundants in indeterminate trusses.

Machine Details: Programmed in Symbolic Optimizing Assembly Program No. I (S.O.A.P.-I). 1,996 locations used. Running time 1 to 5 sec per joint plus punchout of 0.6 sec per member.

Availability: Available through 650 Program Library, IBM Corporation, 590 Madison Avenue, New York 22, N. Y.

Program St. 2: Rigid Frame Pier Analysis

Equipment: Bendix G15

Programmed by: Michigan State Highway Department, Lansing, Mich.

Purpose: To compute design moments in a given pier for various combinations of dead load, live load and temperature.

Limitations: Maximum 5 bays. Rectangular, uniform columns. Continuous footing with uniform soil pressure. Maximum of 3 concentrated loads per bay. Lateral loads cannot be accommodated. Sidesway is not included.

Input-Output: Input includes dimensions of members, loads, and locations of loads. Output includes moments for each combination of loading at various points on the frame.

Machine Details: Programmed in Intercom 1000s using 1,600 commands and 600 storage locations. Runnning time varies from 30 min for two bays to 60 min for five bays.

Availability: Bendix Users Group, c/o Winfield O. Salter, Parsons, Brinckerhoff, Hall & Macdonald, 165 Broadway, New York 6, N. Y.

Program St. 3: Design of a Composite Welded Steel Girder

Equipment: Basic IBM 650

Programmed by: The California Division of Highways, Sacramento, Calif.

Purpose: To produce a complete design including web and flange plate sizes, flange cut-off locations, shear connector data, deflections, etc.

Method: The program approaches the final answer by successive trials. A girder section is selected, analyzed for stress and modified as required to arrive at a solution within specified stress limits. The stress band extends from 300 psi understress to the maximum allowable stress. If a section cannot be located within the stress band, the understress is increased 200 psi. The AASHO Standard Specifications for Highway Bridges (1957) are used.

Limitations: Flange plate sizes, ⅝ x 10 minimum, 3¼ x 28 maximum; web thickness, 1 in. maximum; girder spacing 14 ft-0 in. maximum. If the computer is not required to solve for live load moment, or design the deck slab, wider spacings can be used. The program does not solve girders with pronounced variation in spacing (flared layout), but accuracy is satisfactory for minor flaring.

Input-Output: Input has been designed to permit the engineer to specify plate widths when desired. Otherwise, the computer selects the lightest section.

Machine Details: Programmed in basic machine language, 1,750 drum locations used. Average running time is 45 sec. Restart procedures. Self restoring.

Availability: Available through Highway Engineering Exchange Program. Address: H. E. E. P., Att: Mr. R. M. James, IBM World Headquarters, 590 Madison Avenue, New York 22, N. Y.

Program St. 4: Elastic Properties of Beams

Equipment: IBM 610

Programmed by: Burgwin and Martin, Consulting Engineers, Topeka, Kans.

Purpose: To compute the frame constants of continuous beams.

Method: The solution of the various equations for the desired factors.

Limitations: Moment of inertia must vary parabolically.

Input-Output: Input includes span, "haunching ratio," and length of haunching.
Output includes, for each tenth point, the moment of inertia relative to the minimum, the M/I value, the elastic loads and shears, and the fixed end moments. The stiffness and carryover factors are also provided.

Machine Details: Programmed in basic machine language. Relocatable. Running time approximately eight min per span.

Availability: On exchange basis only: Address: Burgwin and Martin, Consulting Engineers, 408 W. 7th Street, Topeka, Kans.

Program St. 5: Design Analysis: Pile Group

Equipment: LGP-30

Programmed by: King and Gavaris, New York City

Purpose: To analyze the load on the piles in a group in their final driven positions.

Method: Classical theory for pile group computation is used.

Limitations: Maximum number of piles 30; maximum number of loads 5.

Input-Output: Input includes the design location of each pile, the measured deviation of each pile from that location when driven, and the loads on the footing.
Output is the maximum load per pile, the location of that pile, and, if desired, the ratio of maximum to allowable loads and moments due to eccentricity.

Machine Details: Programmed in basic machine language using 2,300 locations. Data locations are fixed, program locations relocatable. Running time approximately 30 seconds.

Availability: Not available until satisfactory exchange procedure has been established.
For further information, contact Dr. Charles P. C. Tung, King and Gavaris, 425 Lexington Avenue, New York 17, N. Y.

Program St. 6: Concrete Deck Girder Design

Equipment: Basic IBM **650**

Programmed by: Missouri State Highway Department

Purpose: To design simple span reinforced concrete tee-girders for H-10, H-15, and H-20 loadings.

Limitations: Maximum span 65 feet.
One exterior and two interior girders can be designed for one pass. Only girder widths of 13, 17, 21, and 25 in. can be designed. No allowance for developing bond is made in calculating bar cutoffs. Combinations of reinforcing bars are limited to predetermined values.

Input-Output: Input includes allowable stresses, roadway widths, type of loading, number of girders, span, deck slab thickness, number of wheel lines to each girder, width, depth and spacing of the girders, haunch, area of steel; number of rows, number of bars in the top row, and size of bar in the top row. Output includes moment at bar cut-off points, steel and concrete stress, design moments and reactions, and stirrup spacing. Some of the input data is repeated.

Machine Details: Programmed in basic machine language. 66 locations are available. Running time is 60 sec maximum, 20 sec minimum.

Availability: Available to other Highway Departments only from the: Missouri Highway Commission, Jefferson City, Mo. Mr. Rex Whitton, Chief Engineer.

Program St. 7: Influence Lines for Moments at Supports of Continuous Spans.

Equipment: IBM 610

Programmed by: Burgwin and Martin, Consulting Engineers, Topeka, Kans.

Purpose: To compute influence lines for moments at the supports of continuous spans due to a unit load at each tenth point.

Limitations: Will handle any number of spans or any variable shape of beam.

Input-Output: Input includes distribution factors for each end of the span and coefficients for fixed end moments for each tenth point. Output includes the final moments at the supports due to the unit load at each tenth point.

Machine Details: Programmed in basic language, tape storage for instructions and machine storage for constants. Readily relocatable. Running time about 57 sec per cycle with about 6 cycles required for a four span symmetrical bridge.

Availability: Available on an exchange basis only. Address: Burgwin and Martin, Consulting Engineers, 408 W. 7th Street, Topeka, Kans.

Program St. 8: Influence Lines for Moment and Shear at Tenth Points in Continuous Spans

Equipment: IBM 610

Programmed by: Burgwin and Martin, Consulting Engineers, Topeka, Kans.

Purpose: To compute the final moments at the tenth points and the shear at the left end in a span for a unit load placed at successive tenth points.

Limitations: Will handle any type of beam or any span length.

Input-Output: Input includes the final moments at the left and right supports due to a unit load at successive tenth points (from Program St. 7), the span length, and the value of one-tenth of the span length. Output includes the final moment at each tenth point due to a unit load at successive tenth points and the shear at the left support for each position of load.

Machine Details: Programmed in basic machine language. Readily relocatable. Running time approximately 8 min per span.

Availability: Available on an exchange basis only. Address: Burgwin and Martin, Consulting Engineers, 408 W. 7th Street, Topeka, Kans.

Program St. 9: Design: Circular Concrete Column with Combined Bending and Axial Load

Equipment: Burroughs L.G.P. 30.

Programmed by: King & Gavaris, New York

Purpose: To develop design curves for any size of circular concrete column.

Limitations: Reinforcing bars are limited to one layer only.

Input-Output: Input includes the description of the column to be analyzed, allowable stress and overstress, and limit of the ratio e/t for uncracked analysis.
Output includes the value of the axial load and moment which will produce the allowable stress at various values of e/t and the stress produced by these loads.

Machine Details: Programmed in basic machine language using 1,500 locations. Running time is approximately 20 sec per solution.

Availability: Program not available until satisfactory exchange procedures are developed. For further information, contact: Dr. Charles P. C. Tung, King & Gavaris, 425 Lexington Ave., New York 17, N. Y.

Division Doings

West Coast Conference on Applied Mechanics

Stanford University was host this fall to the 1959 West Coast Conference on Applied Mechanics, sponsored annually by ASCE (through the Engineering Mechanics Division) and ASME. The program was planned by Prof. Karl Klotter, of ASME, and conference arrangements were made by Prof. James M. Gere, of ASCE. The purpose of the conference, which was first held in 1954, is to provide an outlet for presentation of original research in the field of applied mechanics and to bring together experts in the field.

This year's conference featured three general lectures of outstanding interest —"Nonlinear Systems of More Than One Degree of Freedom," by Prof. R. M. Rosenberg, University of California; "Stress Functions in Dynamic Elasticity," by Prof. E. Sternberg, Brown University; and "Plastic Analysis of Plates and Shells," by Prof. P. G. Hodge, Illinois Institute of Technology.

There were 39 research papers on a wide variety of topics, including transfer matrices, non-linear oscillations, bending of plates, elastic waves, and melting of slabs. The speakers came from Germany and England as well as from all over the United States. The attendance of 200 included specialists in applied mechanics from Puerto Rico, England, Germany, Canada and Iran. Prof. James M. Gere is chairman of the 1959-1960 ASCE West Coast Committee, and Billy J. Hartz is secretary.

Prominent engineers attending the West Coast Conference on Applied Mechanics are pictured during coffee break. They are, in usual order, Dr. R. M. Rosenberg, of the University of California, featured speaker at opening session; Dr. M. V. Barton, of Space Technology Laboratories, chairman of ASME West Coast Committee; Prof. W. Prager, of Brown University; Dr. E. Pestel, of the Technical University, Hannover, Germany; and Prof. Karl Klotter, of Stanford University, program chairman.

City Planning Division

Russell Riley is new chairman of the Division's Publication Committee. The committee invites articles on civil engineering aspects of city planning.

The Division's Committee on Urban Renewal has been reorganized by the chairman, William Claire. The other members are Patrick J. Cusick, Jr., Richard L. Dickman, Eldridge H. Lovelace, Paul E. Middleton, and Robert B. Pease.

Plans are afoot to update the Society's Manual on Land Subdivisions (1939). A committee under the chairmanship of Prof. H. E. Irby, of the University of Missouri, has been activated to get the work going.

Formation of a Steering Committee in the Division's Committee on Research is announced. Its purpose will be to initiate, organize, and coordinate research programs in the Division through close cooperation with the ASCE Committee on Research. Subcommittee chairmen are as follows: J. W. Follin, Research in Urban Renewal; S. W. Grimm, Research in Environmental Planning; Prof. E. M. Horwood, Research in Land Use; and Prof. H. L. Michael, Research in Transportation Planning. Division members wishing to serve on one of these committees or to engage in research in one of the fields are asked to get in touch with the appropriate chairman.

Irrigation and Drainage Division

The Division's Committee on Ground Water has voted to rename the ASCE manual on ground water, "Manual of Ground Water Basin Management." The manual will be particularly slanted toward management aspects of ground water operations. It will eliminate the detailed material on hydraulics of underground flow, now available in texts on ground water.

The Division has decided that the Society's Reno Convention, in June 1960, will be its annual technical conference for the year.

Sanitary Engineering Division

Water, air, and land pollution will be the theme of the Sanitary Engineering Conference, to be held in Cincinnati, January 6-8. Arthur D. Caster, secretary of the Division's executive committee, is acting as general chairman of the conference, the first Division conference to be devoted exclusively to pollution abatement. He will be assisted by Ray Raneri and other members of the Cincinnati Section. Secretary Arthur S. Flemming, of the Department of Health, Education and Welfare, will speak at the dinner meeting, on January 7, on "What Can Our Culture Afford?" Senator Kerr of Oklahoma will address the opening session, on January 6, on "National Policies on Resources Control." The entire conference program is printed elsewhere in this issue.

Soil Mechanics and Foundations

One of the big events on the Division's 1960 calendar is the Research Conference on Shear Strength of Cohesive Soils, set for the University of Colorado, June 13-17, under sponsorship of the Task Committee on Shear Strength of Soils. The general purpose of the conference will be to assemble information on the factors governing the shear strength or failure conditions of cohesive soils. The week-long program will be specifically concerned with the strength characteristics of undisturbed, remolded, and compacted cohesive soils in both fully and partially saturated states. The merits and limitations of testing equipment in use will also be discussed.

A number of government agencies and universities (both U.S. and foreign) whose staffs have performed significant research in the field, have consented to prepare papers for the conference. The registration fee of $15 will entitle registrants to attend the conference and to receive a set of reprints of the papers and a bound copy of the conference Proceedings. Registration will be handled by Dr. J. W. Hilf, Secretary, Task Committee on Shear Strength of Soils, Bureau of Reclamation (Building 63), Denver Fed-

eral Center, Denver 25, Colorado.

The Division's executive committee has under study a policy statement formulated by the Task Committee on Principles of Practice "for guidance in defining the professional and subprofessional elements of soils and foundation engineering." The statement, made in the Task Committee's report to the Board of Direction at its October meeting, reads as follows:

"If the performance of subsurface exploration, field tests, or laboratory tests is to include planning of the work, engineering supervision, selection of part or all of the test procedure, or interpretation of the results, the work is classified as a professional engineering service.

"If the performance of subsurface exploration, field tests or laboratory tests, is to be in accordance with published standard procedures or completely specified procedures, and if no engineering responsibility for adequacy of the procedures or for any interpretation of results is involved, the work is classified as a technical but subprofessional service which is ethically subject to competitive bidding."

Structural Division

The Second National Conference on Fundamental Research in Plain Concrete, which was to have been held next year, has been postponed to the fall of 1961. Tentative plans call for holding the conference at the Allerton Park Conference Center of the University of Illinois, September 5-8, 1961. Attendance will be by invitation. Requests for information should be sent to Prof. Clyde E. Kesler, University of Illinois, Urbana, Ill.

Sponsoring groups, in addition to the Structural Division, are the American Concrete Institute, the American Society for Testing Materials, the Portland Cement Association, the Reinforced Concrete Research Council, and the University of Illinois. The Conference Steering Committee will be made up of representatives from these groups, with Leo H. Corning representing the Structural Division.

Waterways and Harbors Division

New chairman of the Division's executive committee is Prof. J. W. Johnson, of the University of California. He succeeds Col. Lawrence B. Feagin, chief of the Operations Division of the Mississippi River, who will remain on the committee. Richard O. Eaton, chief technical adviser to the Beach Erosion Board, will be the new vice-chairman.

Four Waterways and Harbors programs have been developed for 1960—the first to be a Princeton Conference set for January 19 and 20. Mark S. Gurnee, chief of the Operations Division in the Office of the Chief of Engineers, is new chairman of the Committee on Session Programs. He succeeds Ray Sauer, who is being praised by the Committee for his "outstanding job in developing programs of interest and value to the profession."

ASCE Promotes Curricula Study Conferences

ASCE is carrying the ball in current efforts to improve civil engineering education. The Society, through its Committee on Engineering Education, is working with other agencies in arranging a series of curriculum study conferences at graduate as well as undergraduate levels. Funds to carry on this work are to be furnished by the National Science Foundation (NSF).

Last summer, ASCE Technical Divisions were alerted to the NSF grants available for course improvement studies. (See July 1959, CIVIL ENGINEERING, page 66.) This triggered a chain of events that promises positive action. The ASCE Sanitary Division indicated a need for overhaul of the sanitary engineering curriculum. Then the Cooper Union announced its intentions to sponsor a civil engineering undergraduate curriculum study as part of its centennial program. And the American Sanitary Engineering Intersociety Board (ASEIB) also showed interest in promoting a sanitary engineering curriculum study—at the graduate level.

Through coordination of these interests by the Society's Committee on Engineering Education, two curricula study conferences are scheduled for the summer of 1960. Proposals for financial support of these programs, both of which are co-sponsored by the Society, have been submitted to NSF. Plans for the proposed conferences are outlined here.

Cooper Union Conference

The Cooper Union, acting as administrative and coordinating agent, with ASCE and American Society for Engineering Education co-sponsorship, submitted a proposal for a series of three conferences—the first two to comprise 20 to 30 outstanding civil engineering educators for the purpose of studying and evaluating the aims, scope, and content of civil engineering undergraduate curricula, the third to comprise 150 selected civil engineering and associated engineering educators, for the purpose of discussing the reports and recommendations of the first two conferences.

A Steering Committee of ten met in New York City June 21, 1959, at the invitation of the Cooper Union. Plans were formulated at that meeting for two planning conferences of three days each to be devoted to study and appraisal of current and proposed content of undergraduate curricula in civil engineering education. On the basis of the planning group studies, the Steering Committee would recommend persons most qualified to represent, both in written and oral presentation, the different concepts which underlie the current trends in civil engineering education.

Plans for the third and final conference call for a three-day attendance of 150 selected civil engineering educators from all parts of the country. Papers prepared especially for this conference will be discussed in the hope of reaching agreement on specific recommendations for improvement in civil engineering curricula.

Harvard-MIT Conference

At the request of ASEIB, the Massachusetts Institute of Technology submitted a proposal to NSF for support of a study conference of sanitary engineers and scientists on the improvement of graduate curricula for sanitary engineers, to be held jointly at Harvard and MIT, June 27-29, 1960. This three-day conference is to comprise 50 sanitary engineers and scientists chosen to represent the progressive elements in the sanitary engineering profession and allied scientists from academic institutions, industries, consulting engineering offices, and state, interstate, federal and international health, water supply and water pollution control agencies.

The conference will study the present and future educational needs of sanitary engineers and evaluate and develop graduate curricula to meet these needs.

ASEIB will act as the technical sponsor of the study conference. The professional and technical societies which have representation on ASEIB will be asked to be cooperating sponsors. ASCE, through the recommendation of the Committee on Engineering Education, has already agreed to co-sponsor this conference. The National Academy of Sciences is to be a cooperating sponsor through one of its subcommittees on sanitary engineering and environment. ASEE, not mentioned specifically in the proposal, may also be a co-sponsor.

Employment Conditions Show Important Trends

As Indicated by ASCE's 1953 and 1958 Salary Surveys

C. W. GRIFFIN, M. ASCE
Vice Chairman, ASCE Committee on Employment Conditions; Structural Designer, Allabach & Rennis, Inc., Philadelphia, Pa.

Several thought-provoking trends in the employment conditions of civil engineers and in their reactions to these conditions have been revealed by a comparison of the replies to the ASCE Salary Survey questionnaires of 1953 and 1958. Among these trends are an increase in the percentage of registered engineers and a decline in the number of members in favor of collective bargaining, accompanied by a decline in the number actually members of bargaining groups. Thus it appears that the predictions made in past years about the inevitable growth of pro-union sentiment among engineers have not been realized. Replies to both questionnaires clearly show that the ASCE Committee on Employment Conditions will have the support of the membership as it embarks on a more aggressive program in the Society's effort to improve fees, salaries, and working conditions.

The 1953 and 1958 Questionnaires on Employment Conditions grew out of ASCE concern with the subject of unionization of engineers, a concern that dates back a quarter of a century. A history of ASCE activities in this field, which is briefly summarized here, is contained in the ASCE Memorandum, "Engineers, Unionization, and the Tax Status of ASCE," by W. N. Carey, F. ASCE, and E. L. Chandler, F. ASCE. Under the Wagner Act of 1935, engineers could be, and sometimes were, forced into unions.

To provide guidance for engineer employees so threatened, ASCE in 1937 formed a Committee on Unionization, which later became the Committee on Employment Conditions. In 1946, after nearly a decade of activity, the Committee prepared a policy statement formally approved by the ASCE Board of Directors. This policy statement, adopted by Engineers Joint Council and presented before Congressional committees through its Labor Legislation Panel, was the basis of the professional employee provisions of the Taft-Hartley Act of 1947.

In 1953, a year of heightened interest in the subject of collective bargaining for engineers, a Questionnaire on Employment Conditions was sent by ASCE to some 32,000 of its members. In addition to furnishing data on such subjects as type of employment, registration, etc., this questionnaire was designed to reveal member attitudes toward unionization and facts about union membership.

Employment trends studied

The main purpose of the 1958 questionnaire was, of course, to study trends by comparison with the 1953 results. In so far as possible, questions were preserved in their original form, except when more detailed information was desired or when answers to the 1953 questionnaire revealed a misunderstanding caused by possible ambiguity.

To begin with the factual data provided by the survey, several results show an improvement over those of 1953. There was a better response: 57 percent of the 37,000 members surveyed replied to the 1958 questionnaire in contrast to 53 percent of the 32,000 members surveyed in 1953. This is an excellent return for a survey of this type. A study of returns by membership grade discloses a distribution close to that of the overall Society membership. Therefore the results can be safely projected as an accurate representation of the attitudes of the entire membership.

A significant and heartening fact about ASCE members is the high proportion of registered engineers. In 1958 about 65 percent of the respondents were licensed professional engineers; another 14 percent were engineers-in-training. The question on registration in 1953 grouped registered engineers and engineers-in-training. However, from a comparison of the totals, 79 percent either registered engineers or engineers-in-training in 1958 vs. 76 percent in 1953, it can be inferred that registration is more common among ASCE members today than it was six years ago.

Other purely factual statistics disclosed that fields of principal employment, classified as "government," "private practice," "industry," and "teaching," have remained almost unchanged. Government service has declined about 2 percent, the balancing gains being shown mainly in industrial employment and to a lesser degree in private practice and teaching. Job classifications in the ASCE grades generally ran higher in 1958 than in 1953. This proves that Society members have grown either in professional stature or in self-esteem.

The heart of the questionnaire, of course, concerned member attitudes toward collective bargaining. It may surprise many engineers to learn that the survey results indicate a decline in pro-union sentiment. Question 9 in both the 1953 and the 1958 questionnaires reads as follows: "Do you consider that collective bargaining is, or would be, advantageous to you?" Some 25 percent of the 1953 respondents answered, "yes," in contrast with 18 percent of the 1958 respondents.

When broken into age groups and membership grades, the results of both surveys show a consistent trend—the percentage favoring collective bargaining decreases with increasing age and higher membership grades. Decline in the percentage favoring collective bargaining was highest in the lowest age groups. For example, in 1953 about 33 percent of the 20-30 age group favored collective bargaining; in 1958 only 21 percent did so. This 12-percent decline is more than twice that in all the other age groups combined.

Question 9A of both the 1953 and the 1958 survey asks those who answered "yes" to Question 9—that is, those who consider collective bargaining advantageous—whether they preferred representation by *(a)* a professional employee bargaining group or *(b)* a craft or labor union. The overwhelming majority checked *(a)*. Only 108 out of the entire 21,000 respondents, roughly one-half of one percent, wanted to be labor union members. This is a decline from 1953, when nearly one percent desired this type of representation.

Question 8 of the 1958 questionnaire is similar to Question 9. It reads:

"With respect to membership in a collective bargaining unit

"*(a)* Would you join voluntarily?

"(b) Would you join if necessary to hold present job?"

Although 18 percent of the Society's members believe that collective bargaining is, or would be, advantageous to them, only 14 percent would voluntarily join a union. Thirty-eight percent would join if necessary to hold their present jobs. Again the pro-union percentages decline with increasing age and membership grade. Seventeen percent of the

20-30 age group would voluntarily join a union, 12 percent of the 41-50 age group, and only 6 percent of the 71 and over group. For these same age groups the percentages that would join to hold present jobs are, respectively, 60 percent, 43 percent, and 18 percent.

The decline in the number of those favoring collective bargaining is accompanied by a decline in the number actually members of collective bargaining units. In 1953, 1.1 percent of the respondents belonged to professional employee unions, but only 0.7 percent in 1958. The percentage belonging to trade unions remained unchanged at 0.7 percent. An interesting point is that the number of trade union members in the 1958 survey, 145, exceeded the number that desired representation by this type of union, 108.

Many confused answers were given to Questions 10 and 11, which ask if the individual is a member of a collective bargaining unit, and, if so, to name it and any national affiliate. In 1953 six respondents named their state Society of Professional Engineers as their local bargaining group and NSPE as their national bargaining organization. Accepting only those organizations that definitely qualify, we can conclude that the overall membership in unions has declined from 1.8 percent in 1953 to 1.4 percent in 1958.

Some comments received

A few members felt strongly enough about the subject to include comments on their questionnaires and, in some cases, to write letters. Quite naturally, these opinions covered a wide range in economic and professional philosophy. An anti-union member wrote, "I would not join a union nor would I employ any engineer who was a member of one. Any engineer who joins a union relinquishes all claims to professional status and becomes an educated wage earner who has traded his self-respect and independence for a future that may be governed by arrogant, dishonest incompetents who will limit his future to mediocrity." Another member presented a different viewpoint: ". . . if nothing else will raise the pay status of . . . employee engineers, then they should use collective bargaining to that end." And, of course, there was the ubiquitous cynic, who asked, "Why waste time and money to show the miserable pay and status . . . of engineers?"

Most important conclusion

The most important general conclusion to be drawn from the survey results is that the predictions made in past years about encroaching unionism and the inevitable growth of pro-union sentiment among engineers were premature, to say the least. An *Engineering News-Record* editorial in December 1953 predicted that, ". . . some form of unionization for most employees in such companies (i.e. large organizations employing many engineers) appears inevitable." This conclusion was based on the findings of the 1953 Employment Conditions Questionnaire. At that time, and for several subsequent years, strong drives by AFL technicians' unions and by professional employee unions like Engineers & Scientists of America were expected. But these drives to unionize civil engineers never gained momentum.

Decline in pro-union sentiment among ASCE members is not difficult to explain. Salary is perennially the chief factor in determining one's attitude toward one's employment. A question on the 1958 questionnaire asked pro-union respondents why they were pro-union. Almost unanimously these engineers checked "Economic Benefits." Less than half checked "Working Conditions." During the 1953-1958 period, the median salary at entrance to Grade I (lowest ASCE professional grade) increased 37 percent, according to data published by the Committee on Salaries. (CIVIL ENGINEERING, Aug. 1959, and *Proceedings* Separate No. 2188). Doubtless the economic satisfaction resulting from these salary increases explains the dramatic decline in pro-union sentiment among the Society's youngest members.

Problems other than unionization

For the past several years the Committee on Employment Conditions has concentrated its attention chiefly on problems other than unionization, and the survey results justify this course. At present, Committee members are investigating employment practices in prominent engineering offices of varying size, both public and private.

There are other problems awaiting Committee study in the future. Several letters received in response to the 1958 Questionnaire contain indications of unexplored conditions. One letter-writer refers to an office employing 17 engineers, 6 of whom are not U.S. citizens. According to the letter-writer, these engineers are receiving substandard wages. Unlike American industry, protected in varying degrees from foreign competition by tariffs, and American labor, protected by unions, employed civil engineers are totally at the mercy of the marketplace.

Action by the Board of Direction last year to abolish the Committee on Salaries and to assign its duties to the Committee on Employment Conditions could be a major step in increasing the Committee's effectiveness. The Committee on Salaries has done an excellent job publishing salary data, but it was never authorized to recommend salary scales. However, the way is now open for the Committee on Employment Conditions to assume a more aggressive role.

According to ASCE's legal counsel, the Society can recommend minimum salary scales and fee schedules without jeopardizing its tax-favored status as a scientific, educational organization. [This applies only to the *recommendation* of salary or fee schedules, and does not imply the permissibility of attempts to *enforce* them.] The Society has already worked for economic benefits for some members. ASCE representatives have testified in favor of higher salary scales for engineers in federal government service. ASCE also backed passage of the Keogh-Simpson Bill, which provides for tax-exempt retirement funds for the self-employed.

Member sentiment favors more positive action by the Society in economic matters. The Opinion Research Survey, results of which were published in CIVIL ENGINEERING (February 1958, pp. 61-73), asked a sampling of ASCE members this question: "Should the Society devote more time and effort to improving fees, salaries, and working conditions?" Sixty-seven percent answered, "yes," 22 percent, "no," and a dynamic minority of 11 percent replied, "no opinion." The Committee on Employment Conditions has the support of the membership for the more aggressive program now open to it.

(This article was originally presented by Mr. Griffin at the ASCE Annual Convention in Washington, D. C., before the session of the Conditions of Practice Department on Thursday, October 22, 1959, presided over by Waldo G. Bowman, Chairman of the Department.)

Ben Moreell, Hon. M. Honored by Mechanicals

Ben Moreell, Hon. M. ASCE, is one of two engineers awarded honorary membership in the American Society of Mechanical Engineers during its recent annual meeting. Former chief of the Navy Bureau of Yards and Docks and organizer and commander of the Navy Seabees during the war, Admiral Moreell was cited in part "for his driving force based on faith. His unrelenting effort to realize that faith which has made him such a masterful influence for constructive progress in his community, his state, our nation, and the world at large . . . the dreamer of a dream . . ."

Honorary membership in the ASME is bestowed for "effective and faithful service to the engineering profession and to the public."

ECPD Presents a New Professional Development Idea

A new Professional development "kit," based on the "First Five Years" program of Engineers Council for Professional Development, has been made available by ECPD. Here Cornelius Wandmacher, F. ASCE, retiring chairman of the Committee on Development of Young Engineers, gives one of the kits to John Gammell, ASME, new committee chairman, as George Lobingier, AIEE, vice-chairman of the committee, looks on. The development kit for young graduate engineers includes six items, ranging from a 48-page "Professional Guide" to a "Personal Appraisal Form." The complete kit sells for $2.00 and may be obtained from ECPD.

Civil Engineers Fight Attempt to Limit Practice

A joint committee of ASCE members representing three Local Sections in the New Jersey area—the Metropolitan, Lehigh Valley, and Philadelphia Sections—is cooperating with the New Jersey Society of Professional Engineers in a fight to prevent undue restriction of the scope of the practice of engineering. Similar efforts at restriction have developed recently in other parts of the country.

The situation arose as a result of an allegation brought by the New Jersey Board of Architects against a professional engineer for having designed a country club. The architects' claim was that "by so doing he invaded the field of registered architects and exceeded his prerogatives as a registered engineer." There appears to have been no criticism of the design and no question whatever as to its competence. Preliminary hearings have been held before a Special Statutory Board, consisting of the attorney general and one member each from the New Jersey Society of Professional Engineers, the New Jersey State Board of Professional Engineers, the New Jersey Board of Architects, and the New Jersey Society of Architects.

ASCE ENGINEERING SALARY INDEX

(Prepared Semiannually)

Consulting Firms

City	Current	Previous
Atlanta	1.13	1.13
Baltimore	1.14	1.12
Boston	1.22	1.18
Chicago	1.43	1.36
Denver	1.21	1.21
Houston	1.26	1.26
Kansas City	1.16	1.11
Los Angeles	1.23	1.21
Miami	1.57	1.57
New Orleans	1.18	1.03
New York	1.28	1.25
Pittsburgh	1.04	0.95
Portland (Ore.)	1.25	1.16
San Francisco	1.24	1.24
Seattle	1.06	1.06

Highway Departments

Region	Current	Previous
I, New England	0.90	0.92
II, Mid Atlantic	1.14	1.13
III, Mid West	1.22	1.16
IV, South	1.14	1.08
V, West	1.03	1.02
VI, Far West	1.13	1.11

Sole purpose of this Index is to show salary trends. It is not a recommended salary scale. Nor is it intended as a precise measure of salary changes.

The Index is computed by dividing the current salary total for ASCE Grades I, II and III by an arbitrary base. The base used is $15,930. This is the total of salaries paid in 1956 for the equivalent Federal Grades GS5, GS7 and GS9. Only the annual base entrance salaries are used in these calculations. Index figures are adjusted semiannually and published monthly in Civil Engineering. Latest survey was July 31, 1959.

Hardy Cross, Hon. M. Posthumously Honored

Hardy Cross, Honorary Member of ASCE and retired professor of structural engineering at Yale University, was posthumously honored in October with award of the Frank P. Brown Medal of the Franklin Institute. Professor Cross, whose original moment distribution method revolutionized design procedures for reinforced concrete structures, died at Virginia Beach, Va., last February.

He was cited for "his outstanding career as a teacher of engineering students during the past fifty years . . . for his many contributions to professional publications during this time . . . and for his . . . papers on the moment distribution method of analyzing indeterminate structures."

New Engineering Societies Building—Cuban Style

Brand new headquarters building of the Colegio de Ingenieros Civiles de Cuba was photographed by M. D. Morris, F. ASCE, during recent visit to Havana. Ing. Gustavo Sterling-Alvarez, president, and Ing. Jose S. Martinez-Maderas, secretary, sent the good wishes of the Colegio to ASCE for success in the UEC campaign. The headquarters for Cuban engineers is a handsome fifteen-story reinforced concrete building of ultramodern design.

THERE MUST BE AN EASIER WAY

The Younger Viewpoint

Committee on Younger Member Publications

Milton Alpern, Chairman; 3536 Northview Ave., Wantagh, L. I., N. Y.

Zone I	Zone II	Zone III	Zone IV
Donald Kowtko 510 Millburn Ave. Millburn, N. J.	Albert C. Nelson 250 N.E. 51st Street Miami, Fla.	Walter D. Linzing 4751 No. Paulina Chicago 40, Ill.	Judd Hull 3178 Almeria San Pedro, Calif.

This month's copy has been prepared by Donald Kowtko, the new editor for Zone I.

P. E. Exam Review Course

Many younger members in the metropolitan area will be taking Part III of the New York State Professional Engineering License Examination this coming year. The Younger Member Forum of the Metropolitan Section offers a Review Course each semester (through its Education Committee) which can be of great value to those preparing for the exam.

Last spring, a survey was made of members who had taken the course in the past two years to find out just how well the review course had done its job. Normally about 68 to 75 percent of the engineers taking the exam pass it. However, it was found that 90 percent of those taking the review course passed the licensing exam.

The most prevalent comment throughout the replies was a request for up-to-date exam problems. Almost directly in conjunction with this was a recommendation that the Structures, Surveying, Hydraulics and Sanitary sections all shift their emphasis from review of theory to problem work.

There were mixed comments on increasing the length of the course (which is now twelve 2¼-hour sessions). It was eventually decided that a shift in the use of classroom time to more problem work would probably remedy this aspect.

On the basis of the survey, the course has been revised to place more emphasis on problems. As a matter of fact, the complete examinations for the past ten years have been incorporated as part of the course literature.

Is Review Course Professional?

Even so, some people question the "professional" connotation of any kind of review course for the licensing exam. Is the doubt created by the type of exam itself (that is, should a licensing exam be one that can be prepared for by a quick review of specific problem-solving techniques)?

If we examine the situation even more closely, we realize that this doubt is basically another ramification of the question of how to upgrade the "Engineering Profession." Should the first step here be made by industry itself which can upgrade the engineer by employing the individual engineer's talent to its fullest capacity?

Is it then ASCE's job to work toward a tougher national licensing system, which would truly test the engineer's ability to solve his client's problem logically and ethically? Should the basis for this critical evaluation then be a comprehensive exam which cannot be prepared for by any review course?

A perplexing problem, but one that requires many viewpoints, including yours!

Concerning Engineering Education

An interested contributor who is both a consulting engineer and an engineering educator would like to threw some opinions and questions into the pot:

"Civil Engineering education today is badly in need of guidance from members of the profession. In the past dozen or so years, civil engineering has been constantly losing in the popularity contest with other branches of engineering. Reasons for this are clear: greater lay publicity in space technology, alluring want ads for non-civils, etc. Because of this, enrollments in C.E. curricula have fallen off in many schools all over the country.

"So what does this all mean to us?

"One of the upshots is that—by decision of some of the engineering educators—the C.E. curriculum is undergoing drastic changes! Concurrently with an intensive scientific orientation of other engineering curricula, C.E.'s are joining the bandwagon and dropping or reducing course time in most of the "practical" flavored engineering college subjects. If you ask at your own alma mater you will probably find that subjects such as surveying, highways, design (drafting), photogrammetry, geology, etc., are being moved wholesale out of the curriculum in favor of more math and science.

"Is this what you think will help the civil engineering profession in which you have chosen to cast your lot? Or is the pendulum swinging too far and is there need for a more balanced curriculum? Are you and your fellow engineers aware of what is going on in engineering education or are you assuming that the educators are taking proper care of everything?

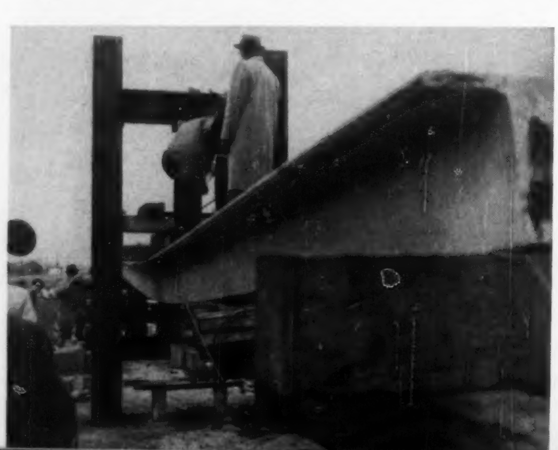
"Are the educators acting for the needs of the civil engineering profession, or are we viewing a panic response to a crisis that may not even exist?"

Successful Field Trip

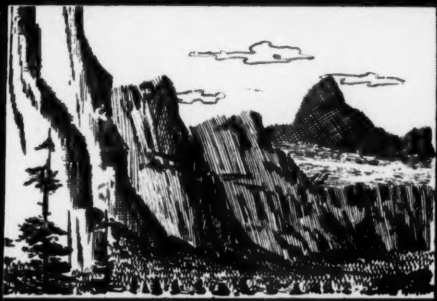
If the success of a field trip is measured by the attendance, the Metropolitan Section's Younger Member Forum had its most successful trip in many years last spring. According to Mike Fischetti, chairman of last year's Arrangements Committee, 350 engineers came to the Atlantic Prestressed Concrete Company in Trenton, N. J., last spring. Mike writes:

"The members were given an opportunity to see actual production processes. Prestressed concrete bridge beams, similar to those being widely used in the Federal Highway Program, were being cast by the pretensioned draped-strand technique. This technique offers greater design flexibility than is available with the usual straight wire pretensioning. Wall panels were precast in 6 x 20-ft sections showing the ease with which a building superstructure can be mass produced.

"After a buffet luncheon, the characteristics of prestressed concrete subjected to overload conditions were demonstrated in Atlantic's test bed. A 50-ft, clear span double tee member was subjected to extreme overload conditions and still sustained the load even at a 20-in. deflection."



Double tee test beam after overload application endures 20-in. deflection without failure. Metropolitan Section's Younger Member Forum views test at prestressed concrete plant.

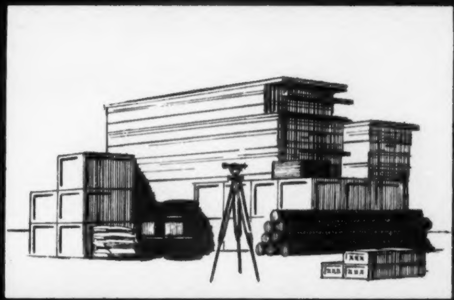


When the terrain looks like this

or like this

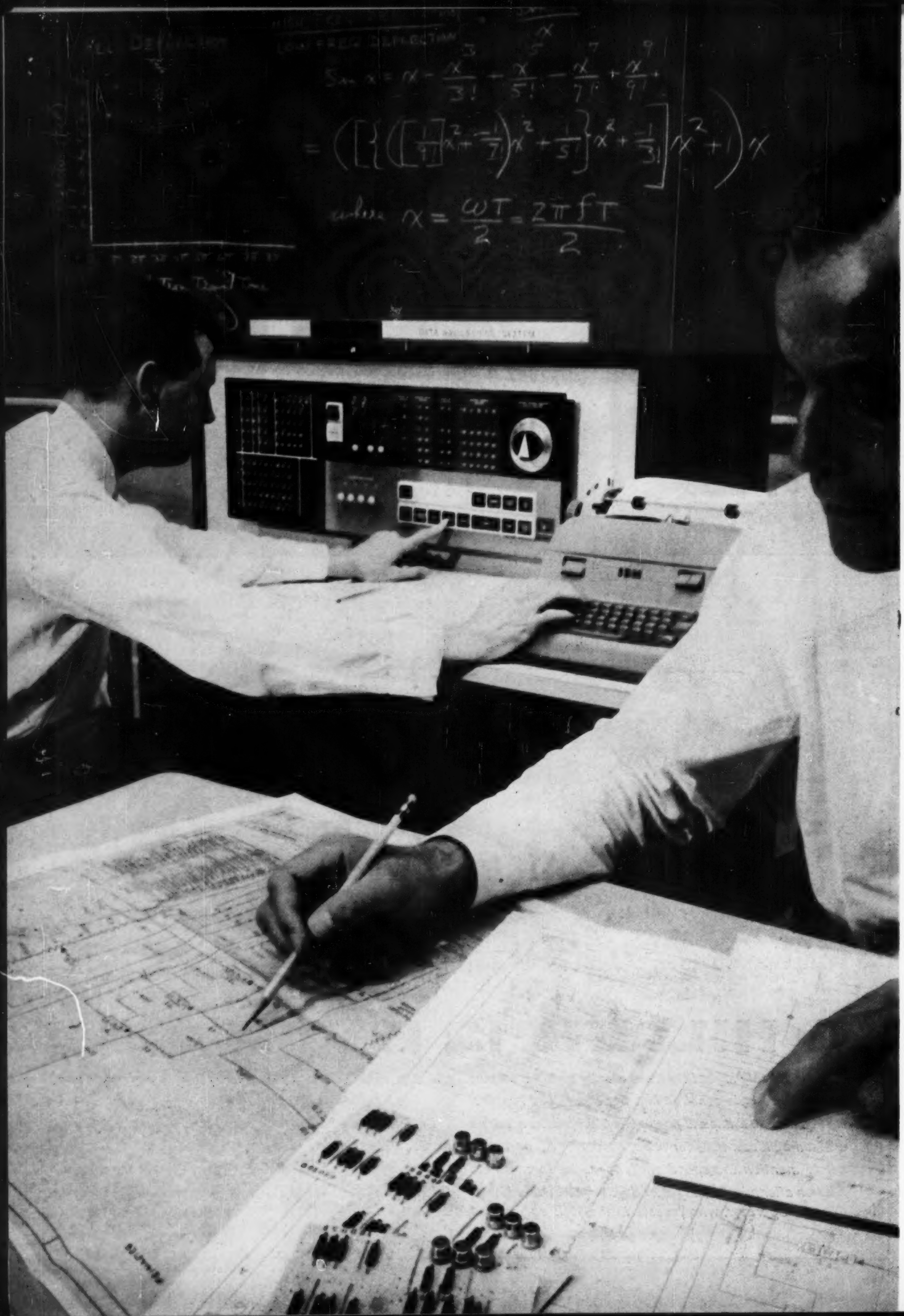
or like this

and you must get men



and equipment

to do the job



$\sin x = x - \frac{x^3}{3!} + \frac{x^5}{5!} - \frac{x^7}{7!} + \frac{x^9}{9!}$
$= \left(\left[\left\{\left(\frac{1}{9!}x^2 - \frac{1}{7!}\right)x^2 + \frac{1}{5!}\right\}x^2 - \frac{1}{3!}\right]x^2 + 1\right)x$
where $x = \frac{\omega T}{2} = \frac{2\pi f T}{2}$

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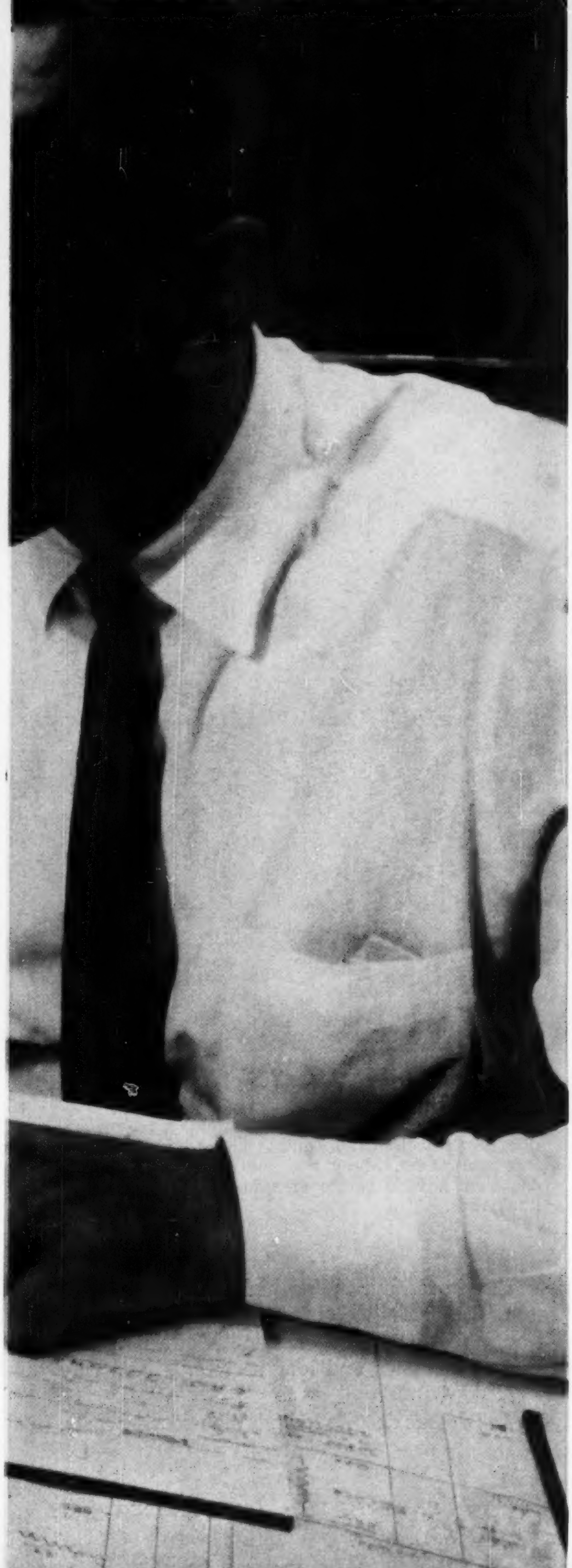

Here is a new and powerful stored program, desk-size computer designed to bring more computing ability to engineering problems at low cost.

Transistorized throughout, the IBM 1620 is the only solid state, core-storage computer in its price class.

Easy to learn—easy to operate—easy to communicate with—this powerful computer relieves engineers from routine calculations—frees them for creative tasks.

Data is fed into the 20,000-digit magnetic core memory of the 1620 via punched paper tape. Alpha-numeric output is printed at the console typewriter in desired format, under stored program control.

This new computer with its two-address instruction format and variable field length, gives you up to 50% more storage capacity than a fixed word-length system.

All notations of input and output are in the decimal system. An unlimited decimal field and internal self-checking assure accuracy. A powerful two-address instruction format adds to the 1620's timesaving capabilities.

Programming is simplified through the use of IBM Fortran—a mathematical programming system which compiles machine instructions from algebraic and English language notation. A library of programs for standard engineering computations will also be part of the 1620 package.

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Albuquerque's traffic engineering department finds: **"ALUMINUM**

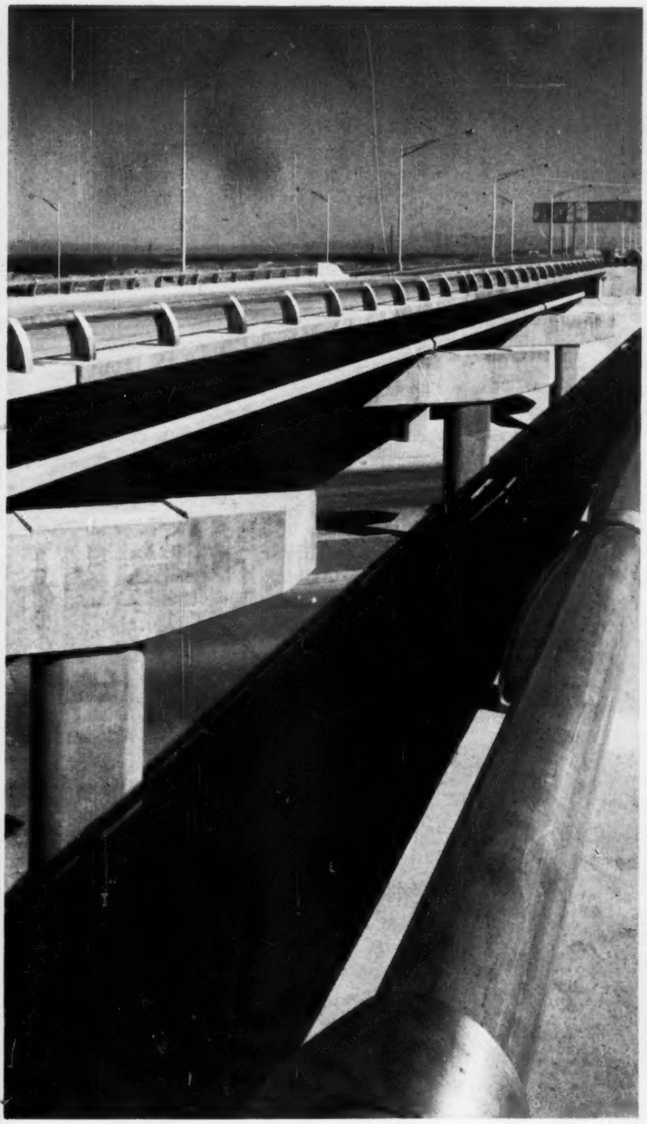
SAVES ON INSTALLATION, UPKEEP—Only aluminum mast arms come in 25-ft lengths needed to swing traffic signals out over the center lanes of Albuquerque's 86-ft wide streets. Faster, easier installation of lightweight aluminum, plus elimination of upkeep, repays its premium cost fast. And once aluminum signal heads are up, there's no repainting with its high cost and bottling-up of traffic. For corner-mounted signal posts, installation is a one-man job, while setting a 200-lb steel post ties up a three-man crew.

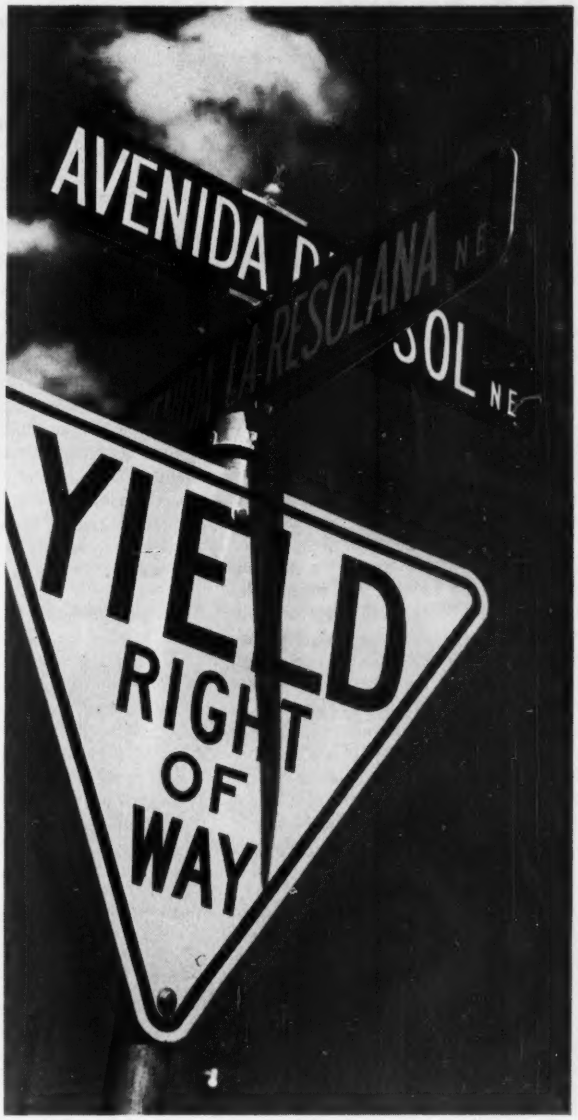
LOOKS GOOD IN MANY STYLES—Over 1,500 aluminum lighting standards now grace the streets of Albuquerque. Attractive, durable and maintenance-free, they cost less to ship and handle, go up faster with less man power. Many available styles give lighting engineers a wide choice of standards, brackets and luminaires.

"First cost is not our only consideration in recommending highway equipment," says Mr. Edwin Beck, Administrator, Traffic Engineering Department, of Albuquerque, N. M. "We analyze total cost for the entire economic life of a proposed installation, taking into account low maintenance and long service. That's why we ask for—and get—aluminum!"

Alcoa® Aluminum can stretch your tax dollars despite today's high-soaring costs.

COSTS LESS PER YEAR!"





MAKES FIRST COST YOUR LAST COST —Alcoa Aluminum bridge railing stays bright even in coastal and industrial areas, eliminates painting costs, which may run as high as a dollar per lineal foot each year. High-strength aluminum alloys provide an added safety factor, yet installation is fast and easy . . . just assemble and bolt in place.

STOPS PITTING, PAINT FLAKING—In the spring, Albuquerque experiences winds of such high velocity as to have a virtual sand-blasting effect on traffic control signs. Experience there has proved that aluminum will effectively withstand pitting from the grit carried by these blustery spring winds; other materials just don't stand up. Some 4,500 Albuquerque street-name installations are aluminum, too, because paint holds on tighter to aluminum, even through strong, ultraviolet ray exposure at the city's 5,000- to 6,000-ft elevation.

In bridge railings, lighting standards, traffic signs and signal heads, aluminum's light weight saves on installation; its resistance to corrosive moisture, salt and fumes ends maintenance and appearance problems for good. Let Alcoa's jobber-erectors and Alcoa's technical experts show you how to move *more* traffic at *less* cost with highway products of Alcoa Aluminum. For help with your own problems, write Aluminum Company of America, 1913-M Alcoa Building, Pittsburgh 19, Pa.

For exciting drama watch "Alcoa Presents" every Tuesday, ABC-TV, and the Emmy Award winning "Alcoa Theatre" alternate Mondays, NBC-TV

ALCOA ALUMINUM
ALUMINUM COMPANY OF AMERICA

Your Guide to the Best in Aluminum Value

NOTES FROM THE LOCAL SECTIONS

(Copy for these columns must be received by the fifth of the month preceding date of publication)

The **Los Angeles Section** held its annual joint dinner meeting with the Structural Engineers Association of Southern California in September. The speaker this year was Charles Luckman, of Luckman & Associates, Architects, who dealt with Los Angeles' urban redevelopment program known as the Bunker Hill Project. Under consideration since 1924, the project as planned by Luckman & Associates is now approaching fruition. Mr. Luckman emphasized his conviction, relative to architect-engineer relationships, "that the best aesthetic-engineering results are achieved through consultation between the architect and an independent consulting engineer firm."

Dr. Jacob Feld, consulting engineer on part of the Lincoln Performing Arts Center, New York, and structural designer of the Coliseum, and the Guggenheim Museum, both in New York, is one of the few technically trained observers to have traveled through western Russia in recent years without official escort. It was, therefore, an eager and attentive audience of **Metropolitan Section** members and guests who met recently to hear Dr. Feld report on construction progress and methods in the USSR. In general, Dr. Feld confirmed the impression held in this country that western Russia is embarked upon a vast and ambitious program of public works, although the hundreds of photographs he brought back indicate that there are few paved highways in existence and that many of the techniques displayed at the recent Russian Exposition in the New York Coliseum for constructing apartment houses are nowhere in evidence. However, as he carefully pointed out, his tour did not include the newly-built industrial cities of eastern Russia and Siberia, where it is quite possible that more modern equipment and methods are in common use.

Dr. Feld's talk has been taped for broadcast by the Voice of America.

The **Mid-South Section** elected Henry C. McGee as president at its annual meeting on October 17. Also elected were W. D. Dickinson, Jr., as vice president and William E. Isaacs as secretary-treasurer. Directors are John W. Courter, Robert M. Scholtes, Richard G. Ahlvin, H. P. Seavy and W. D. Painter, who was elected to serve out the term of Col. W. P. Jones, Jr., who resigned in August 1959.

The October meeting of the National Capital Section featured presentation of awards for high scholarship and notable contribution to Student Chapter activities. Recipients are (left to right), James E. Clark of the Catholic University; Arnold Lee Snyder, Jr., of George Washington University; and Elroy Smith, of Howard University. Presentation was made of Dr. Robert Hechtman, of George Washington University.

The **Mohawk-Hudson Section** recently sponsored a tour for 150 civil engineering students of various portions of the Northway, a new limited-access, toll-free superhighway from Albany to Glen Falls. The students, mostly members of the Student Chapters at Union College, Schenectady, and Rensselaer Polytechnic Institute, had an opportunity to observe modern methods of steel erection as well as the placement and driving of piles. V. J. Burns, an engineer in the New York Department of Public Works, explained many of the interesting and unusual engineering features of the highway.

The **Nashville Section** has adopted an ambitious program for 1960. According to newly-elected President Edward M. Dougherty, the Section "will attempt to educate the public concerning proper building methods, with respect to procedure and planning. Roughly 60 percent of the structures in Middle Tennessee are poorly designed and executed because the builders failed to seek the advice of structural engineers or architects—they just built. Our Society, during this year, will encourage potential builders to contact it for free advice on just how they should go about planning new construction. We hope that chambers of commerce, county courts, school boards and individual builders will take advantage of this service, which we will furnish without charge."

The October meeting of the **National Capital Section** was held as a joint affair with the American Institute of Electrical Engineers, the American Society for Engineering Education, and the National Society of Women Engineers. Guest speaker was Dr. Martin A. Mason, F. ASCE, dean of engineering at George Washington University, who emphasized the need for a radical change in the education of the engineer to enable him to take the leadership society is asking of him. A feature of the meeting was the presentation of student awards (see photo).

Congratulations to the Oregon Section for a recent issue of its monthly publication, *The Oregon Civil Engineer,* which appropriately honors the state's centennial. Says President Walter Bushnell in an editorial foreword, "During this 100th year of statehood for Oregon, we of the **Oregon Section** are proud to be part of a community which has done so much toward the molding and shaping of this great state's growth and development." Several well selected, well written and well illustrated articles devoted to the past century of civil engineering progress in its effect on the development of the

NEW! CRONAFLEX® DRAFTING FILM

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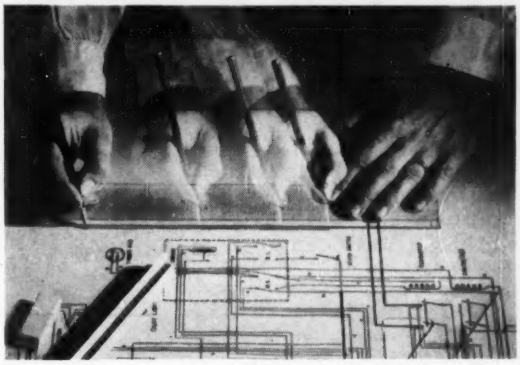

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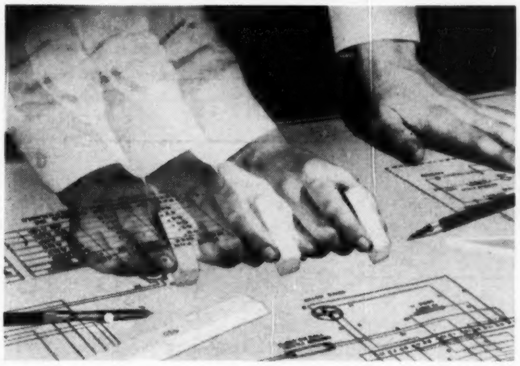

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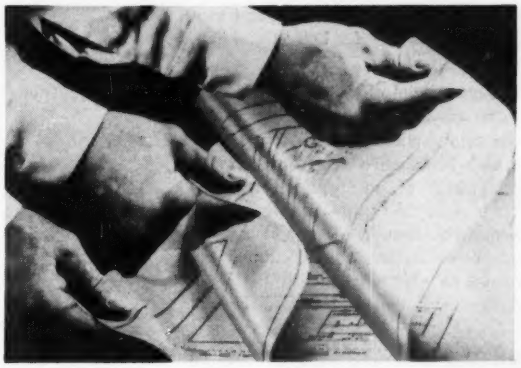

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If drawings are made anywhere in your operation, you can use CRONAFLEX Drafting Film to great advantage. CRONAFLEX Drafting Film joins the widely acclaimed CRONAFLEX line of films: Direct Positive, Contact and Projection. You can go from original drawing to final reproduction with the same product line on the same strong base. For more information write: E. I. du Pont de Nemours & Co. (Inc.), Photo Products Department, Wilmington 98, Delaware. In Canada: Du Pont of Canada Limited, Toronto.

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BETTER THINGS FOR BETTER LIVING . . . *THROUGH CHEMISTRY*

**DuPont's trademark for its polyester photographic film base.*

state and the city of Portland make up the interesting 20-page issue.

"We are being kicked into space," Rear Admiral Jack P. Monroe told the **San Francisco Section** at its meeting on October 20. Admiral Monroe, Commander of the Pacific Missile Range at Point Mugu, pointed out that we must go into space for our own survival. In comparing the relative status of the United States and Russia in the space race, he painted a brighter picture than most other recent accounts. Aside from Russia's lead in the development of large boosters, we can do anything she can do, including high accuracy guidance, he said. This is explained by the belief that even though our satellites are smaller we are probably getting more than four times as much data, because Russia has not been able to minimize instrumentation to the extent that we have.

The **Syracuse Section** has chosen "Engineer Planning for the Year 2000" as the theme of the entire year's schedule of programs. First speaker of the year, Dale Brossert, executive secretary of the Erie County, N. Y., planning board, introduced the general field of engineer planning as it applies to metropolitan areas . . . New Section officers are Walt Neubauer, president; Irv Grossman, first vice president; and Prof. Lou Goodman, second vice president.

A large group of members and students heard George Shafer, vice president in charge of engineering at Armco Drainage and Metal Products, talk on the development of multi-plate-corrugated metal pipe at the October meeting of the **Wisconsin Section.** The group toured the plant before dinner. After dinner six scholarships were presented by the Bates and Rogers Foundation to Jeff Brooks,

Eric Anderson, Don Coffey, Harlan Hirt, Jong Sol Kim and Merl Wending, of the University of Wisconsin. A scholarship was presented to Ervin Herness by the Aring Equipment Company and the Wisconsin Chapter of the APWA presented a scholarship to Ben P. Lubeck.

Francis S. Friel (second from right), Past President of ASCE, spoke at the Delaware Section's first meeting of the season on "Society Affairs." Shown with Mr. Friel are, left to right, M. F. Wood, chief engineer of the du Pont Company; E. Wilson, chief engineer of the Hercules Powder Company; and Delaware Section President C. O. Simpson.

ASCE CONVENTIONS

NEW ORLEANS CONVENTION

News Orleans, La.
Jung Hotel
March 7-11, 1960

RENO CONVENTION

Reno, Nev.
June 20-24, 1960

ANNUAL CONVENTION

Boston, Mass.
Hotel Statler
October 10-14, 1960

TECHNICAL DIVISION MEETINGS

SANITARY ENGINEERING CONFERENCE

Cincinnati, Ohio
Netherland-Hilton Hotel
January 6-8, 1960

Sponsored by

Sanitary Engineering Division

RESEARCH CONFERENCE ON SHEAR STRENGTH OF COHESIVE SOILS

Boulder, Colo.
University of Colorado
June 13-17, 1960

Sponsored by

Soil Mechanics and Foundation Division

HYDRAULICS CONFERENCE

Seattle, Wash.
University of Washington
August 17-19, 1960

Sponsored by

Hydraulics Division

NUCLEAR CONGRESS

New York, N.Y.
Coliseum
April 3-8, 1960

Program Manager
ASCE

LOCAL SECTION MEETINGS

Arizona—Regular monthly meeting of the Phoenix Branch on December 14. Charles Haley will review the traffic problems of the Phoenix area. Contact Earle Cassidy, Phoenix Branch vice president and program chairman, for additional information.

Cleveland—Regular monthly meeting scheduled for Friday December 18. Further information may be had by contacting the Section Vice President, Trygve W. Hoff.

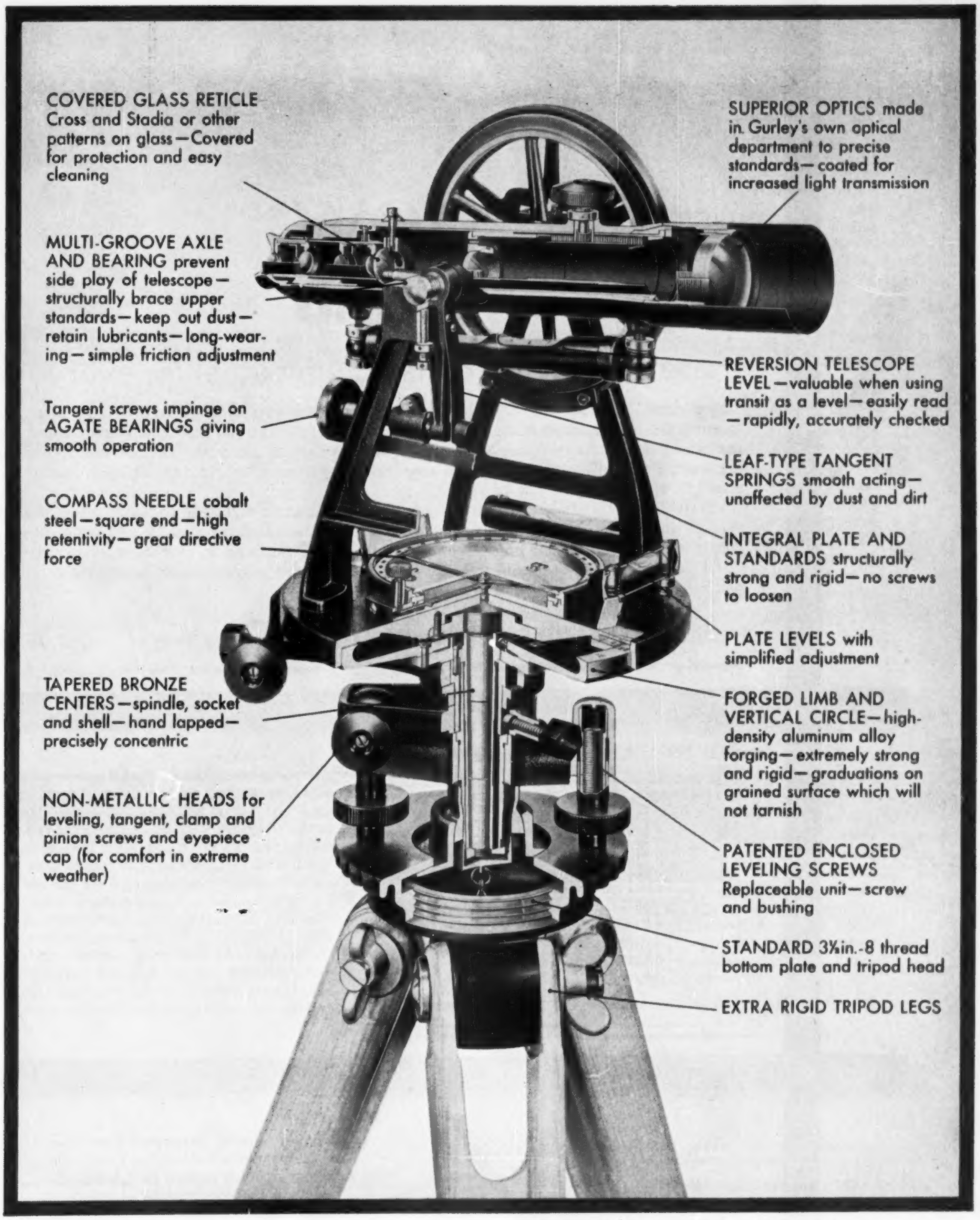
Illinois—Weekly luncheon meetings at the Engineers' Club, Chicago, every Friday, at 12 noon.

Intermountain—Regular monthly meeting on the fourth Friday of each month.

Los Angeles—Regular monthly meeting of the Santa Barbara—Ventura Counties Group on December 15 at the Oxnard Elks Club, at 7:00 p.m.

Metropolitan—Regular monthly meeting in the Engineering Societies Building December 16 at 6:15 p.m. A coffee hour will be held prior to the meeting.

South Carolina—Annual winter meeting at the Wade Hampton Hotel, Columbia, S. C., January 15, at 10 a.m.



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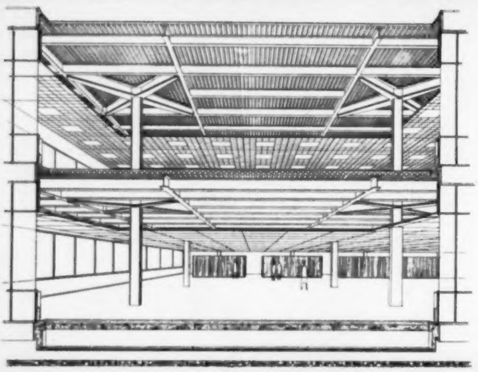
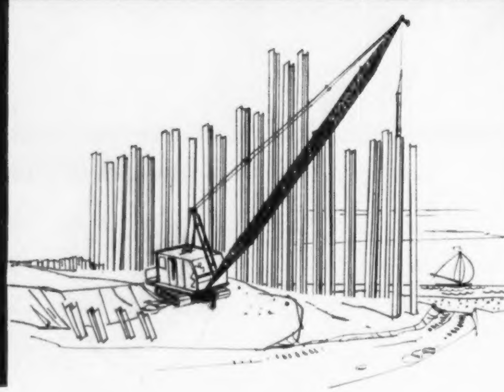
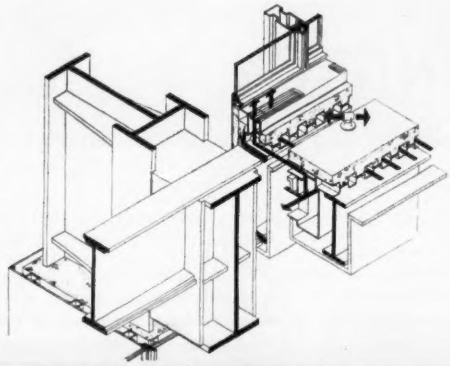
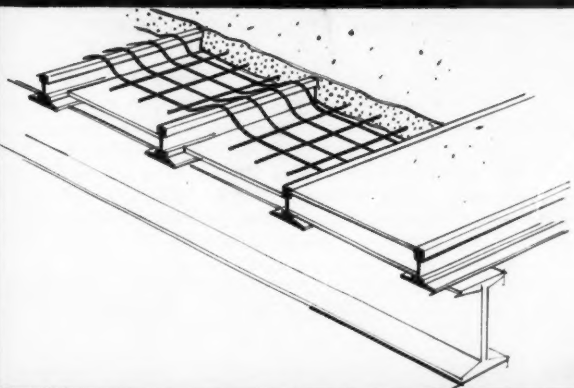


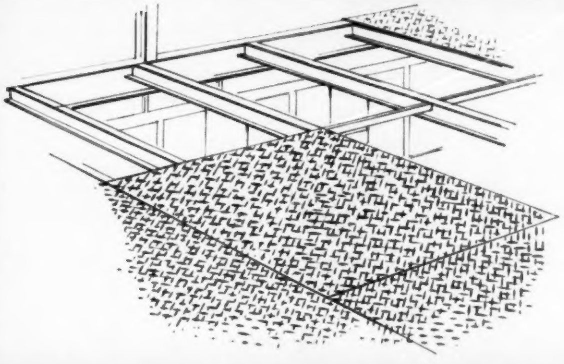




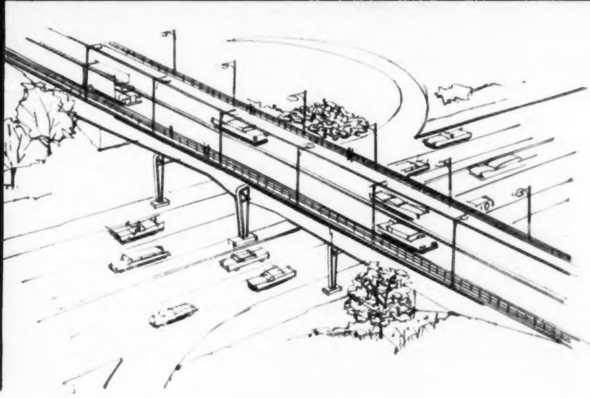
unique solution to a building frame problem—This special "torque" joint was the answer to a number of problems in the construction of a building frame where wind load was an important factor. The joint distributed the load between columns and spandrels as well as distributing both live and dead load between columns and girders. Fabricated from Inland Steel Plate at the same time as the vertical supporting columns, the "torque boxes" made field connection with girders a quite simple job. Note also the cellular floor construction—an Inland solution to the problem of handling phone, heating, cooling, utility ducts of all kinds.



weight-saver for short-span roofs... Inland sub-purlins—Inland sub-purlins are especially designed to provide a lighter, more efficient member for shorter-span roof construction. In addition, they make a real contribution to the modern good-looks so evident in today's construction. Installation is fast, easy, and entirely without waste, for Inland sub-purlins are cut to the length required for the specific roofing job. Mill painted, ready for clipping or welding to the purlin member, they're ideal for gypsum, aggregate or grout fill—all types of pre-cast or poured roofs.



new way to take advantage of prefabricated floor plate—The inherent strength of versatile Inland 4-Way Safety Plate permits its use as an integral part of the supporting structure. Used everywhere as a long-lasting material for floors, walls and stairs in industrial plants and institutional buildings, 4-Way Safety Plate is here used as part of the supportive framework. ¼ inch floorplate was used and a remarkable design span of 48 inches between centers was achieved. Additional advantages on this job were ease of cleaning and maintenance, fire safety, and slip-proof protection for future tenants and their employees.



how to stretch a girder for 500 feet—Inland Plate and Structural steel is doing its bit to make the nation's network of superhighways a reality. To span an overpass under construction in the very heart of a huge metropolitan city, Inland prefabricated sections for the enormous girders. Fifty such sections ranging from 80 feet to 120 feet in length and tapered 4½ feet to 7 feet in height were built-up from Inland plate, transported to the site where they were welded into giant girders stretching for more than 500 feet to support multiple-lane roadways.

BY-LINE WASHINGTON . . . . .

The manner of payment—not the type of work—determines whether a man is legally a "professional." That's the result of the Supreme Court's recent action in refusing to review a lower court award of overtime pay to employees of a Los Angeles mechanical-electrical consulting engineer. Ten employees of the Far West Engineering Co., Inc. (November issue, page 96) sought overtime pay because they were paid on an hourly basis, arguing that they were not "professionals" within the meaning of wage-hour laws. The employer contended that the men were graduate engineers, employed in "creative and design" activity, and thus were professionals. Overtime pay now due, under terms of award by lower courts, is as much as $3,000 per man in some instances.

* * *

Engineering employees can be required to join a construction trades union, under terms of a California statewide contractor-union agreement that is held legal, in another action where the U.S. high court refused to review lower court action. An action by the Marysville, Calif., consulting firm of Saint Maurice, Helmkamp & Musser, against the National Labor Relations Board, made these points: The engineering firm was hired to prepare earthwork computations and drawings for a joint-venture working at the Travis AFB. Operating engineers struck the job to force consulting firm employees into that union—though the men were already members of the Engineers & Scientists of California—on the strength of a contractor-union agreement which requires the "subcontractor" to deal with the same unions as primes. The consultant argued he couldn't be forced into interfering with his employees' choice of union. But the NRLB ruled the contract clause was legal, even though the strike was illegal. Lower courts upheld the NLRB's position.

* * *

Employers seeking to recruit college engineering graduates got their knuckles sharply rapped twice recently, over "wild" bidding and inducements to students. Martin Mason, dean of engineering at George Washington University, has published a "code" for recruiters, outlawing all special payments, gifts and bonuses and prohibiting recruiters from bidding over other offers already made to students. And the U.S. Chamber of Commerce issued a six-page leaflet (with College Placement Council, Inc., of Bethlehem, Pa.), which comments that "employers should not offer special gifts to students to induce them to take jobs." Commenting on his "code," Dean Mason said: Wild bidding for engineering graduates is "disillusioning to new engineers, delays their adjustment as professionals, makes some quit in disgust."

* * *

An important new source of research money and research leadership is now getting firmly established in Washington, with the powerful backing of some 53 insurance companies. It is the Insurance Institute for Highway Safety, which has a million-dollar budget for its first year of operation. Activities, according to President Russell I. Brown, will go forward on two fronts: Grants-in-aid for studies of safety problems and solutions, and a "direct action" program, where the Institute will go into a state (by invitation only) to provide central direction and coordination toward development of a state-wide official safety program. Eventually, a national program will evolve, but it will be in cooperation with existing programs and studies, officials insist.

* * *

Although it goes out in relatively small amounts, **there's considerable construction and engineering money in the health research facilities program,** now in its fourth year under Public Health Service Administration. A total of $120 million was expended in the first three years of the program (from 1956), and the $30 million annual rate will continue through 1961 under current authorization. Some measure of the size of individual grants can be obtained from the fact that 82 grants recently announced called for a total of $16.2 million, to help build and equip health research facilities at 72 institutions in 30 states.

* * *

Any thought of a proposal to Congress to cut down on the urban part of the Interstate Highway System has been hastily dropped in Washington. You can see why the urban sections seem a tempting target for costs-minded officials—and also why no politician would permit any cuts—from these figures: urban roads total slightly less than 12 percent of the total mileage included in the interstate system, but they account, at present prices, for about 42 percent of the total cost. However, something like 45 percent of the total revenue for the highway trust fund is paid by users in urban areas. And some states, like California and Texas, will spend more than half their total highway allotments in urban areas.

* * *

The drive for some sort of a single **U.S. government transportation agency** will be resumed when Congress reconvenes, although the chances of any action in a short and politically minded session are considered slim. But New Jersey's Senator Clifford P. Case, for one, indicates he will seek legislation that would consolidate various regulatory agencies, bringing what he calls "haphazard rulings and subsidies" under one head. Previous proposals along this line have included bringing the Bureau of Public Roads under such a central agency.

* * *

As to transportation, **the waterways operators** are really worried over a growing campaign—becoming more and more apparent—aimed at charging some sort of toll for use of federally maintained and improved waterways. The campaign began to grow last year, with comments and questions from Congress over costs of federal river and harbor work. Lately, speeches of staff members of several committees investigating transportation matters have increasingly taken the tone that some sort of charges should be made, to reimburse the federal government for its spending and make all forms of transportation "truly competitive."

NEWS BRIEFS . . .

Slight Decline in Construction Forecast for 1960

A decline in housing will offset gains in the other major construction categories next year and produce a slight drop in total construction contracts, according to the annual outlook statement recently released by the F. W. Dodge Corporation. The downturn would be the first since the end of World War II, the Dodge analysis indicated. However, it would be small, amounting to a drop of about 1 percent below the record-breaking 1959 total.

The outlook statement indicates that non-farm housing starts in 1960 will total about 1,250,000 units. In terms of contracts, they will be down about 10 percent in physical volume (as measured by floor area) and 8 percent in dollars. Because housing is the largest single construction category, this decline is expected to counterbalance gains anticipated in non-residential building and heavy engineering contracts.

The report emphasized that the 1960 total will still be huge, with contracts amounting to $36,040,000,000, the second highest figure on record, and it pointed out that practically every construction category other than housing should show gains over 1959.

Most of the strength next year is expected in non-residential contracts, with every major building type showing gains over the 1959 levels. Total non-residential contracts in 1960 are estimated at $12.4 billion, up 7 percent from 1959. In terms of physical volume, floor area is also expected to increase 7 percent. Heavy engineering contracts in 1960 are forecast to total $7.8 billion, a gain of 2 percent over the estimated 1959 level.

Total private and public housing starts are expected to decline in 1960, primarily as a result of financing difficulties, to 1,250,000 on the current Census Bureau basis of measurement. This would represent a drop of 10 percent from an estimated 1959 level of 1,390,000 units. The report states that "there seems to be, at this point, little likelihood of legislative action which might further stimulate homebuilding in 1960, but a sharp decline would greatly increase pressure for such action, and it is not beyond the realm of possibility." Total dollar volume of residential building contracts next year is forecast at $15.9 billion.

Despite the slight decline anticipated in total construction contracts next year, the report says that "the market for construction materials and services in 1960 will be among the very largest in history and the forerunner of ever more prosperous years ahead."

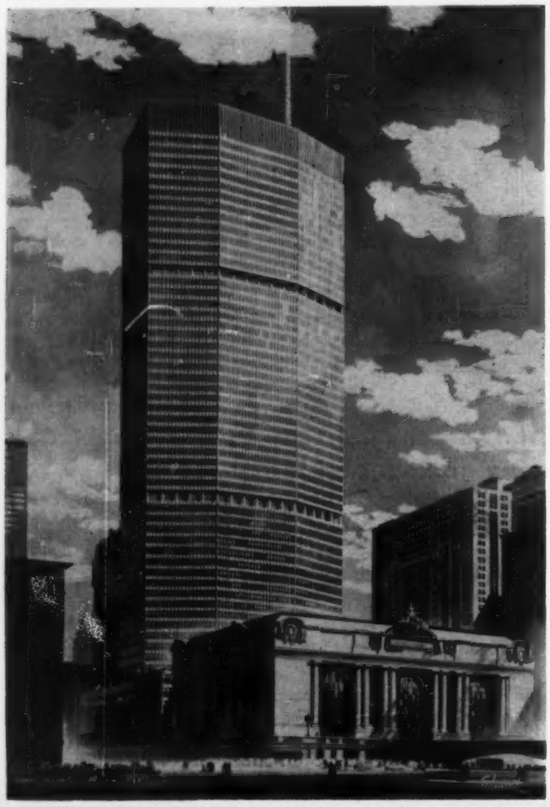
Loan Made to Italy For Atomic Power Plant

A credit of $34 million to assist in the establishment in Italy of the largest nuclear power plant to be built for a private European company has been announced by the president of the Export-Import Bank of Washington. The credit, the first to be issued by the bank for a single atomic power project, will be used for the 165,000-kw Enrico Fermi installation of Societa Elettronucleare Italiana (SELNI), scheduled to go critical in about four years. The unit is designed to permit an ultimate increase in output to 225,000 kw as reactor technology advances.

The present loan will finance expenditures in the United States for equipment, materials, and services—including processing and fabrication of the initial fuel core—required for the installation of the nuclear power plant. Total cost of the plant is estimated at the equivalent of $64 million.

The Westinghouse Electric International Company is providing the nuclear equipment and design, as well as the electric generator. Gibbs and Hill of New York is engineering the project in collaboration with SELNI engineers. The steam turbine will be built by Franco Tosi, Legnano, Italy, under license from Westinghouse. To assist in evaluation of the nuclear aspects of the project, the Export-Import Bank obtained the services of Pickard-Warren-Lowe Associates of Washington, D. C., consulting engineers for atomic energy developments.

Of three nuclear power plants now planned in Italy, the Enrico Fermi Plant will be the only one to be virtually privately owned. The exact site of the plant



New York City to Have World's Largest Office Building

A towering new backdrop for Grand Central Terminal will soon rise 830 ft, just north of the terminal building in New York City. Described as the most ambitious postwar office project, Grand Central City will have 2,400,000 sq ft of floor space—more than any other office building in the world. The $100 million structure with its elongated tower will reign over the many recently constructed buildings on New York's rapidly changing Park Avenue. Construction of the 59-story steel frame structure will start next year and is expected to be completed late in 1962. The building's facade will be glass and mosaic—blocks of precast concrete with stone chips. Consulting engineer for the job is James Ruderman, F. ASCE, and Emery Roth and Sons are the architects.

in northern Italy has not yet been determined.

The proposed nuclear plant is a heterogeneous pressurized reactor using light water as both moderator and coolant, and having a three-region, three-cycle core. It is the type most used in the United States. The Yankee Atomic Electric Company is currently building a prototype of the SELNI plant at Rowe, Mass.

M. T. Davisson Wins Second Raymond Award

Melvin T. Davisson, A.M. ASCE, a civil engineering instructor at the University of Illinois, has won the second annual Alfred A. Raymond Award of $1,000 for the best of thirty papers submitted in the competition that closed September 1. Sponsored by the Raymond Concrete Pile Company, a division of Raymond International Inc., and named after the founder of the firm, the award was established "to encourage originality in research and development in the field of foundation engineering."

Mr. Davisson's paper is an investigation of the lateral stability of a flexible pier built recently on the New York side of the Hudson River to replace existing Piers 38, 39, and 40. Mr. Davisson received his bachelor's degree from the University of Akron in 1954 and a master's degree in civil engineering at the University of Illinois in 1955. He worked two years for Clark, Daily & Dietz, consulting engineers, and then transferred to the University of Illinois.

Honorable mentions went to G. D. Morrison, engineer, Structural Engineering Services Ltd., Calgary, Alberta; F. E. Richart, Jr., F. ASCE, professor of civil engineering, University of Florida; and W. C. Dias, engineer, Kellogg Division, American Brake Shoe Company.

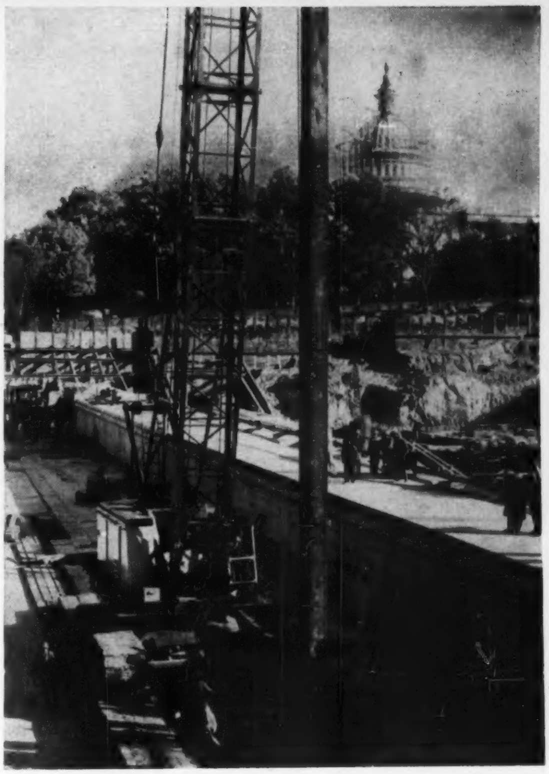
Canada to Finance Mekong River Survey

Canada will finance a $1,300,000 hydropower and irrigation survey of the Mekong River in Southeast Asia under the Colombo Plan. All of Canada's principal air survey companies will be employed on the big two-year job, which will include air photography, ground survey, and map compilation. The Photographic Survey Corporation Limited of Toronto has been awarded a contract to act as management engineers for the project.

The survey is part of an international development project conceived by the United Nations Economic Commission for Asia and the Far East, with the long-range goal of raising the standard of living in Southeast Asia.

The 1,600-mile stretch of the Mekong under survey extends from the Laotian-Burmese border to the South China Sea. In flow, the Mekong is comparable to the St. Lawrence River.

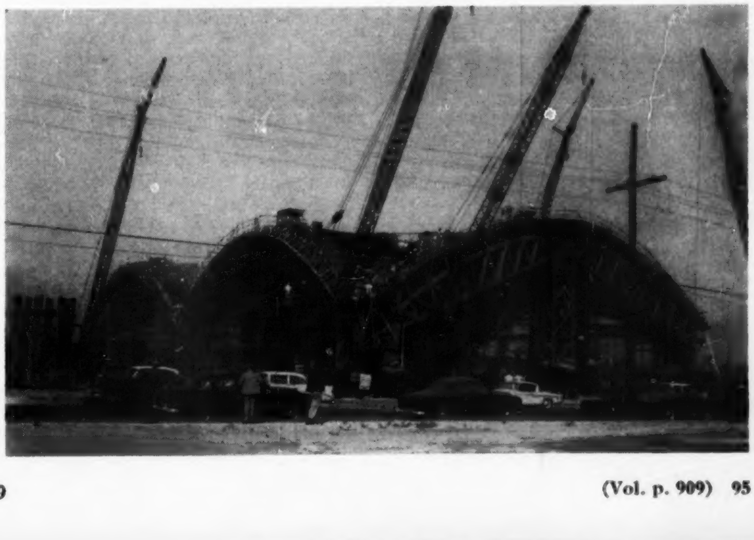
First piece of steel—a 12-ton column, 14 in. wide and 48½ ft long—is set by crawler crane equipped with a 150-ft boom at site of $66 million Additional House Office Building in Washington, D. C. Fabricator and erector for the 23,000 tons of structural steel to be used in the building is the Bethlehem Steel Company. At the occasion of placing the first steel, J. George Stewart, Architect of the Capitol, gave the erection crew an official Capitol flag. The flag will be affixed to the highest piece of steel when the 720 X 450-ft structure is topped out.

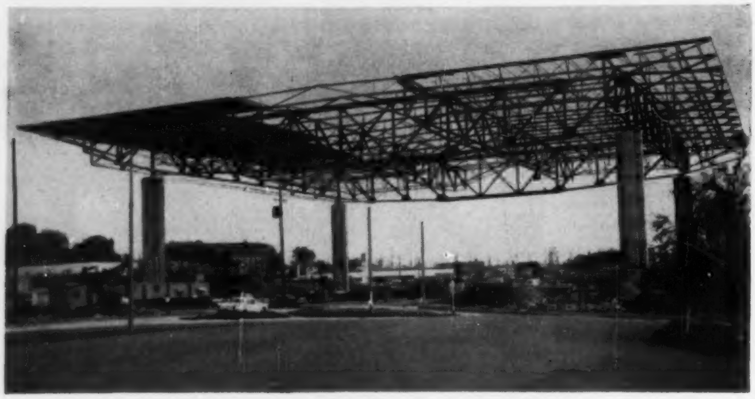


First Steel Set for Additional House Office Building

Thin-Shell Concrete Roof for Automatic Post Office

Gigantic roof, the size of three football fields, is under construction in Providence, R. I. The 7,000-ton reinforced concrete roof for the world's first fully mechanized post office is said to be the only thin-shell concrete roof with spans of over 60 ft ever to be erected on elastic supports. These supports are designed to permit the roof to move slightly on its column supports in response to atmospheric and temperature changes. Completion of the roof, which covers an area of 145,000 sq ft, is expected within ninety days. The $20,000,000 post office is being constructed for the Post Office Department by Intelex Systems Incorporated, a subsidiary of International Telephone and Telegraph Corporation. Structure was designed by the late Frederick H. Paulson, former Director of ASCE and partner in the Providence firm of Charles A. Maguire & Associates, who died on September 29.





Steel Roof for Portland's Memorial Coliseum

Perched on four 70-ft-high columns is the steelwork covering Portland's $8 million Memorial Coliseum. The four reinforced concrete columns cantilever 95 ft off their foundations and form the corners of a 240 X 270-ft rectangle inside the walls but outside the arena area. Extending 45 and 60 ft beyond the columns, the roof creates a 360-ft-square building, which requires no support from the still-to-come glass and wood exterior walls. The 1,250 tons of steel for the roof required 35,000 high-strength bolts, 25,000 rivets, and a great deal of fabrication know-how. November 1960 is the target date for the new coliseum, which will have a seating capacity of 14,000.

Scope of Outside Work Defined for Employees

In a recent directive to employees in the Department of Health, Education and Welfare, Commissioner Arthur S. Flemming explains the department's policy in regard to outside work. An obvious outgrowth of the Bureau of Reclamation's recent troubles over outside consulting services (July 1959 issue, page 80), the directive restricts outside consulting work for employees of the Department of Health, Education and Welfare.

Says the directive, "It is the policy of the Department to authorize the undertaking of consultative services for a fee only in unusual and appropriate situations which clearly divorce the services rendered by the employee on a fee basis from his official duties with the Department. With respect to all consultative services which are not a part of an employee's official duties, fees are prohibited except where:

"1. The services are performed outside working hours, or while the individual is in leave status.

"2. The services are performed without expense to the Government.

"3. They are not provided to organizations, institutions, or state and local governments with which the official duties of the employee are directly related or indirectly related if this indirect relationship is significant enough to permit the existence of a conflict or apparent conflict of interest.

"4. They are not services which can be obtained without cost from the Government."

The directive notes that the "apparent conflict of interest" (referred to in Paragraph 3) "is particularly likely to occur if the consultative services are provided to commercial firms, public or private institutions, or governmental units which have recently negotiated, or may in the near future seek a contract or grant from the organizational unit in which the prospective consultant is employed."

Environmental Engineering—A New Curriculum at RPI

In an attempt to prepare young people for careers in engineering aspects of world wide control of health and conservation of natural resources, Rensselaer Polytechnic Institute has introduced a course in environmental engineering. Concerned with the creation of the most favorable living and working conditions available, environmental engineering uses engineering to conserve and develop the world's resources for the general well being of man, as measured by comfort, convenience, productivity, and the absence of disease. Both a four-year undergraduate course leading to the degree of Bachelor of Environmental Engineering and a program of graduate courses leading to advanced degrees are available at RPI.

Differing from conventional programs in this field, the new curriculum will place more emphasis on mathematics and the fundamental sciences with a wide range of electives. The curriculum will prepare individuals for professional careers in water utilization and conservation, air pollution and its control, community and industrial waste treatment, and disposal and environment problems of the nuclear industry.

Additional information may be obtained from the Director of Admissions, Rensselaer Polytechnic Institute, Troy, N. Y.

Baltimore Dedicates New Cargo Terminal

Dedication of the Port of Baltimore's newest waterfront facility, an open-deck cargo pier to be operated and maintained by the Baltimore and Ohio Railroad, took place recently. The new $4,000,000 Hawkins Point Marine Terminal will serve the growing Marley Neck industrial area. It is the first waterfront facility completed by the Port Authority, which was created three years ago by the State of Maryland to develop modern port facilities. It is 90 ft wide and 720 ft long, but has been designed so that it can be extended an additional 600 ft as traffic demands. The facility was constructed on the site of an Army ammunition pier destroyed by fire in 1951.

Design of the Hawkins Point Pier was prepared by the Engineering Department of the Baltimore and Ohio. The contractor was the McLean Construction Company, of Baltimore.

Two Builders Will Receive Moles Awards

William Denny, of Garden City, N.Y., and George Morgan Drake, of Minneapolis, Minn., have been named as the 1960 recipients of the awards given annually by The Moles for "outstanding achievement in construction." The announcement was made at a dinner meeting of The Moles, an association of leading figures in the tunneling, dam-building and heavy construction industry.

Messrs. Denny and Drake are the 20th pair of honorees in a series that started in 1941 and that numbers among its winners former President Herbert Hoover, Robert Moses, Admiral Ben Moreell, Peter Kiewit, Harvey Slocum and Lou Perini. The award is considered the highest recognition that can be accorded for service to the American construction industry.

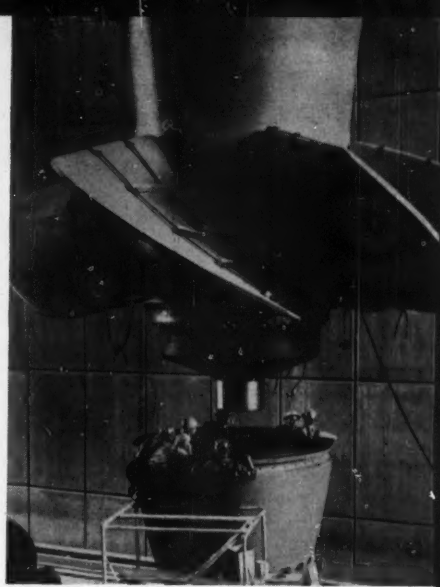
Mr. Denny, a native of Sedalia, Mo., has been with Merritt-Chapman & Scott since 1927 and has been executive vice-president in charge of its construction department since 1953. Mr. Drake, a native of Madelia, Minn., is president and general manager of Johnson, Drake & Piper, Inc., the company he helped form in 1914.

Gross National Product Down in Third Quarter

The gross national product was at an annual rate of \$478½ billion in the third quarter, according to the Office of Business Economics of the U.S. Department of Commerce. This was \$6 billion under the all-time high reached in the second quarter of the year, reflecting mainly the loss of production in steel and related lines. The total flow of goods and services to final purchasers was again higher. Manufacturers' inventories were drawn down in satisfying the demand.

Despite the production setback—the first in a year and a half—most of the ground that has been gained in the cyclical upswing through midyear was held. Real national output, adjusted for price changes, in the third quarter was nearly one-tenth above the cyclical low reached early last year, and considerably higher than at the pre-recession peak of 1957. National income estimates for the summer quarter are not yet complete, but changes outside the strike-affected areas seem generally to have been limited.

First Power from Priest Rapids Dam



Giant turbine runner, with a diameter of 23 ft 8 in. from blade tip to blade tip, recently started driving a generator to produce first commercial power at Priest Rapids Dam on the Columbia River in Oregon. When completed the dam will have ten generators with a total capacity of 788,500 kw. The job comprises the first phase of a project that will create the third largest source of hydroelectric power in the United States—more than 1,350,000 kw.

Engineering Survey of N.Y.C. Subways Ordered

How safe are the New York City subways? And how reliable? To determine the answers to these questions the Board of Estimate has unanimously ordered a four-month \$70,000 investigation of the system. The New York City consulting firm of Coverdale & Colpitts has been chosen to make the survey. The firm specializes in transit studies and has made several earlier surveys of the city's transit lines.

The present study was initiated by Mayor Wagner as a result of recent articles in metropolitan daily papers. The articles criticized the subway equipment and said that it is being neglected to a point where public safety is jeopardized. The study will include visual examination of subway and elevated tracks, elevated structures, and auxiliary equipment now in use. It will also look into the Transit Authority's maintenance-of-way department.

An interim report shows that track and structures investigated to date are safe.

Construction Exposition Set for Latin America

The first construction and building materials show ever held in Latin America will take place in San Juan, Puerto Rico, June 3-9, 1960. Leonard Rogers, vice-president of Orkin Eposition Management, has announced his firm will manage the week-long event.

The event, called "Construction Caribbean," will give U.S. exhibitors an opportunity to display their wares in the booming atmosphere of the Caribbean construction market. Puerto Rico was selected because its industrialization program has established it as the United States' best per capita export customer. Approximately 25 percent of housing construction in all Latin America is underway in Puerto Rico. Mr. Rogers estimates that Caribbean construction now totals over \$17 billion annually. Emphasis in the exhibition will be on construction and maintenance of industrial and institutional plants and residential housing.

The exhibition will be sponsored by the Economic Development Administration, with the Puerto Rico College of Engineers, Architects and Surveyors as co-sponsors.

Water—A Major Latin American Problem

Latin America's shocking water situation was highlighted in a recent Annual Convention paper, presented by Harold R. Shipman, F. ASCE, chief of the Branch of Environmental Sanitation of the Pan American Health Organization.

"It is estimated," he said, "that 61,440,000 people are now without water service in the Latin American countries. Furthermore, during the past ten years, the rate of installation of new water service has not even kept up with the population increase. This means that, at present rates, by 1980 there will be at least 121,680,000 people in Latin America without water services."

Mr. Shipman told the group that the Pan American Health Organization (PAHC) is the agency of the Organization of American States responsible for all matters related to health. He said that PAHO engineers have been concerned with problems ranging from water supply, sewage disposal and air pollution to broad problems of training sanitation personnel of various countries in modern techniques. He also said that in the future PAHO engineers will place major emphasis on community water supplies.

"Through the use of the best engineering, financial, and administrative minds in the world," Mr. Shipman concluded, "PAHO hopes to solve the serious water supply and sanitation problems confronting the Latin American countries."

U. S. Charges Plot to Restrain Rebar Trade

A United States government anti-trust action charges conspiracy to restrain trade in the sale of steel reinforcing bars. The Department of Justice has brought suit in Federal District Court in San Francisco against six producers of steel, twelve fabricators of reinforcing bars, and the Western Reinforcing Steel Fabricators Association of Oakland, Calif.

Charges against the fabricators and their trade associations included these anti-competitive practices: Allocation of rebar fabricating jobs among themselves; making collusive bids and adopting uniform contract terms; agreement not to buy rebars from foreign sources; and attempt to keep general contractors from doing their own fabricating.

The Justice Department has asked that steel producers be required to sell bars directly to the contractors everywhere in the country, not just in the Western States. The anti-trust division is especially concerned because any restriction on use or economy of reinforcing bars is detrimental to concrete construction, a principal competitor of structural steel.

Offshore Tanker Terminal Towed to Iraq

Unusual deep-water tanker terminal starts a 7,000-mile tow from England, where it was built, to the Persian Gulf, 24 miles offshore from Iraq. When the rig arrives, it will be separated into two sections, each of which will put down hydraulically operated legs for "walking" on the floor of the 80-ft-deep Gulf. Two mobile units will then serve as working platforms for building a 1,200-ft-long terminal for the Basrah Petroleum Company of Iraq. When the project is completed, both platforms will be incorporated into the terminal as permanent structures—one will become a heliport and the other will support permanent living quarters. The rig is operated by a joint venture sponsored by Raymond International (U.K.), Ltd. The other two partners are Richard Costain Middle East, Ltd., and DeLong Overseas, Ltd.

EXAM GEMS

by

Reggie Strashn

R. ROBINSON ROWE, F. ASCE

There is more psychology than mathematics applied to buying deep-freeze units on the installment plan, as witness the diverse answers to EXAMGEM No. 5.

Mr. A compared the $510 cash price with the alternative of 24 equal monthly payments of $25 and deduced that the vendor had added $90 for interest in 2 years. He computed the interest rate at 90/2/510 = .088, or 8.8 percent. Simple.*

Mr. B wasn't so simple. He knew about shylocks and usury. He wrote that the debt tapered from $510 to $0, averaging $255, so that the rate on average debt was 17.6 percent. Mark him "E" for effort.

Mr. C wrote a ½-page complaint about the formula furnished with the problem in garbled typescript. The steno hadn't jacked up the exponents, so how could you expect him to know whether the numerator was $(l+i)^{n-1}$ *or* $(l+i)^{n}-1$? He demanded that this problem be thrown out. (Confidentially, Mr. C had protested at least one problem on each of the last 11 exams!)

Mr. D didn't need a formula. He let the interest rate per month be i. He discounted each of the installments to its present worth by compounding that rate and equated that sum to the cash price, writing the equation in telescoped form:

$$510 = 25(l+i)^{-1} + 25(l+i)^{-2} + \ldots 25(l+i)^{-23} + (l+i)^{-24} \ldots (1)$$

This form is easy to write and to check. The exponents account for 24 installments and the number of months from now they will be paid and for which they must be discounted to compute present worth. Next he multiplied each term by $(l+i)$:

$$510(l+i) = 25 + 25(l+i)^{-1} + \ldots 25(l+i)^{-22} + (l+i)^{-23} \ldots (2)$$

Next he subtracted (1) from (2), noting that most of the terms cancel, leaving only three:

$510\,i = 25 - 25\,(l+i)^{-24}$ whence

$20.4\,i + (l+i)^{-24} = L$ . . . . (3)

Apparently using a log-log rule, he solved this quickly by trial:

$i =$ .01	.204	+ .786	= .990
.02	.408	+ .621	= 1.029
.013	.265	+ .734	= .999
.0134	.2734	+ .7265	= .9999

Concluding that the monthly rate was 1.34 percent, he multiplied by 12 and underscored 16.1 percent as his answer for the required annual rate of interest. Ingenious—and almost good enuf.

Mr. E was just as ingenious, and perhaps too precise, for he used logarithms to refine the trial solution and find $i =$ .01343188. But, more important, he knew the annual rate was not 12 times the monthly rate and went on to compute it by compounding $1.01343188^{12} = 1.1736397$ and gave 17.364 percent as his answer. Mark him "A" for able.

Need for that last step established this problem as a little gem, but the real lesson is more practical. Most texts give at least six formulas for compound-interest problems in present worth, amortization, etc., with confusing similarity. Unless used daily and thoroly understood, they are best supplanted on an examination by Mr. D's method. Write an equation like (1) fitting the data. It will be a geometric series, easily reduced to a form like (3) by eighth-grade arithmetic. The unknown may be the present worth, the installment, or the period instead of the interest.

In epilogue, D and E are registered, A and C are draftsmen, and B is a deep-freeze salesman.

EXAMGEM No. 6

Being abstract, the next problem is nominated reluctantly, but it extends the combination of arithmetic and the log-log rule. Since it was given in California in 1957, let's imagine we are comparing alternative plans for the conservation and utilization of smog.

GIVEN: PLAN "A" calls for an initial investment of $300,000, and expenditures of $10,000 a year for the first 20 years and $20,000 a year thereafter. It also calls for the expenditure of $200,000 at a date 20 years hence and every 20th year thereafter.

PLAN "B" calls for an initial investment of $500,000 followed by a single investment of $100,000 30 years hence. It also involves periodic expenditures of $50,000 every 10 years.

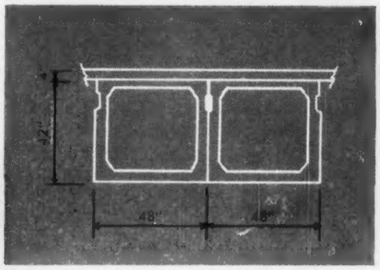
REQUIRED: Compare PLAN "A" and PLAN "B" on the basis of the capitalized cost of perpetual service, using interest at 4 percent.

**Note the triple entendre; the computation,* the *interest,* and Mr. A are *all simple.*

Bureau of Standards Starts New Publication Program

For more effective dissemination of its findings to science and industry, the National Bureau of Standards has started publication of a "Journal of Research" in four separate sections. Readers will now be able to subscribe only to those sections of the "Journal" that fall within their particular field of interest. The four sections—Physics and Chemistry, Mathematics and Mathematical Physics, Engineering and Instrumentation, and Radio Propagation—will provide the basic medium by which the Bureau reports its findings to the scientific community.

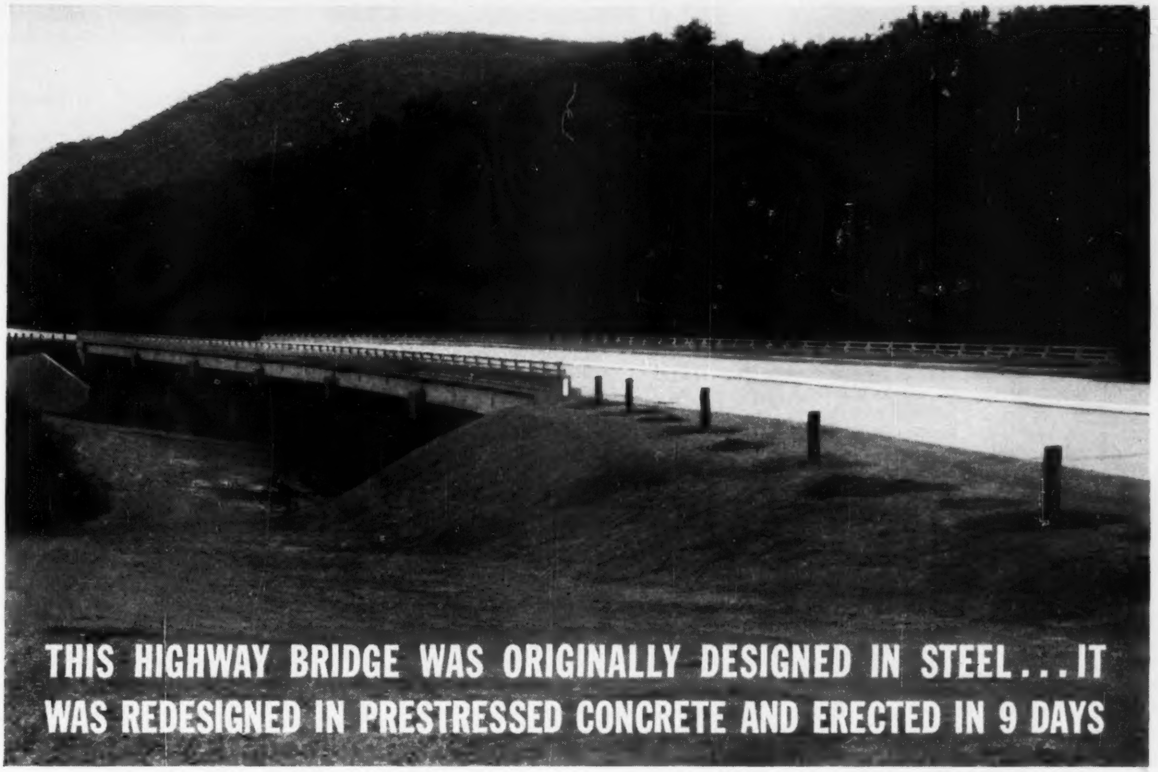
In addition, the editorial scope of the "Journal" has been broadened to cover the Bureau's technical program as completely as possible. For additional information write to the Office of Technical Information, National Bureau of Standards, Washington 25, D. C.



far left
Detail of bridge showing cut outs in beams at pier cap, giving maximum clearance. Structure's 96 box beams were furnished through American Marietta Co. by Pennsylvania Prestress Co. and Schuylkill Products Company. Other five bridges fabricated by American Marietta Company.

left
Partial cross section of a deck-type bridge, showing two precast rectangular sections and poured-in-place concrete topping.

below
Overall view of Structure #4, one of 6 highway bridges designed in Prestressed Concrete by American Marietta Company. Contractor: C. J. Langenfelder, Baltimore, Md. Stress-relieved strand by Roebling.



This bridge is Structure #4, Duncannon By-Pass, Perry-Dauphin Counties, Pennsylvania. Because of prestressed concrete's inherent economy and the possibility of wintertime erection, it was redesigned from steel to prestressed, an alternate permitted by the Pennsylvania Department of Highways.

It is particularly interesting since underclearance conditions required special cut outs at the ends of all the beams, making it, perhaps, the only bridge of its exact type in the country. It was designed by the Concrete Products Division, American Marietta Company, Chicago, Illinois, and is a curved structure with six 80' spans utilizing 42" x 48" box beams with a composite slab. It is on a spiral runout of a horizontal curve with the post-tensioned piers being radial, thus making the outside fascia beams longer than the inside fascia beams. The post-tensioned pier cap girders (precast at job site), plus the 96 pretensioned box beams for the deck were erected in 9 working days.

Maximum headroom was obtained by using 48" wide x 50" deep post-tensioned pier cap girders and by cutting out the beams at the point where they framed into the girders (see detail above).

Roebling has been a strong and ardent advocate of the prestressed concrete method since its introduction in the United States. Our knowledge and experience covers all aspects and we will be happy to share it with you. Your need may be as simple as the names of prestressed fabricators in your area or, perhaps, your question may have to do with beam designing procedure or a request for data on typical prestressed members. Whatever it may be—and for whatever structure: schools, garages, transportation terminals, piers, bridges or office buildings (to name a few)—you have only to address your questions to Construction Materials, John A. Roebling's Sons Division, Trenton 2, New Jersey.

Now available on request—Roebling Data Sheet PC 946 "Design Procedure for a Simple-Span Prestressed Concrete Beam." Based on ACI-ASCE Committee 323 Report "Tentative Recommendations for Prestressed Concrete," this procedure is an excellent guide for engineers in the design of prestressed concrete members.

ROEBLING

Branch Offices in Principal Cities
John A. Roebling's Sons Division
The Colorado Fuel and Iron Corporation

DECEASED

Edward H. Anson (M. '40; F. '59), age 56, since 1953 senior vice president of Gibbs & Hill, Inc., New York City consulting engineers, died on November 5, while visiting at Red Bank, N. J. Mr. Anson joined Gibbs & Hill in 1925, after graduating from New York University, but left two years later, only to return in 1931. From 1943 to 1945, Mr. Anson was president of a foreign affiliate of the company in Mexico City. A recognized authority on electric traction, he was associated with the electrification programs of a number of railroads.

John F. Brown (M. '38; F. '59), age 79, former chief engineer of the U.S. Steel South Works in Chicago, Ill., died in Chicago on October 18. Following his retirement from the South Works fourteen years ago, he became a consultant to U.S. Steel. During World War II, while serving with the Corps of Engineers, Mr. Brown supervised the construction of the Geneva Steel Works in Utah.

Ranjit Mohan Chatterjee (A.M. '50; M. '59), age 42, executive engineer with the Calcutta Port Commissioners in India, died of drowning in Calcutta recently. Mr. Chatterjee, a graduate of Calcutta University and Bengal Engineering College, was with the Calcutta Port Commissioners from 1943 until his death. He had responsibility for the maintenance, repairs and extension of Calcutta Jetties, New Howrath Bridge and the foreshore of Calcutta along the River Hooghly.

Irving Ballard Crosby (Aff. '29), age 68, consulting engineer-geologist of Boston, Mass., died there recently. Mr. Crosby, a S.B. graduate of the Massachusetts Institute of Technology and an A.M. graduate of Harvard University, for over thirty years conducted investigations for agencies of the Federal Government, states, municipalities and foreign governments on dams, reservoirs and water supplies. From 1949 to his death he acted as a consultant for the Philippine Government and for the Belgian Government.

Allan T. Dusenbury (M. '13; F. '59), age 81, retired consulting and civil engineer and former Director of ASCE, died in New Orleans, La., on October 20. Long active in public works, he was one of the founders of the waterworks system in Jefferson Parish and designed many drainage systems throughout Louisiana. From 1908 until 1917 when he entered private practice, Mr. Dusenbury was associated with Edward Wisner in land reclamation. He was a graduate of the University of Michigan.

Frederick H. Frankland (M. '18; F. '59), age 77, partner in the New York consulting engineering firm of Frankland and Lienhard died there on November 1. Before joining the firm in 1947, Mr. Frankland was technical director, chief engineer, and director of engineering of the American Institute of Steel Construction.

Robert James Gammie (M. '42; F. '59), age 70, retired chief engineer of the Texas & Pacific Railroad, died recently in Dallas, Tex. He was a graduate of the Agricultural and Mechanical College of Oklahoma. Mr. Gammie was with the Texas & Pacific Railroad from 1919 on, working his way up from instrumentman to chief engineer in 1941. He was in charge of the Dallas Union Terminal Company Committee for the remodeling of the Union Terminal.

Martin W. Hall (A.M. '06; M. '59), age 83, a civil engineer for the City of New York from 1897 to 1951, died in Long Beach, L.I., on November 7. Mr. Hall during his long career in municipal service supervised work on bridges throughout the New York area, and held several patents on inventions in connection with sewer work. He was a graduate of Cooper Union.

Joseph F. Kunesh (M. '37; F. '59), age 69, former city engineer for Honolulu and dean of the College of Applied Science at the University of Hawaii, died in Seattle, Wash., on October 24. Mr. Kunesh had been in Seattle since leaving Hawaii in 1951—until his retirement in 1956 as chief engineer and executive vice president of Layne Pacific, Inc. He held bachelor's and master's degrees in civil engineering from the University of Wisconsin.

Henry Bennett Machen (M. '09; F. '59), age 83, who joined the New York City Department of Water Supply in 1905 and retired eight years ago, died in New York on October 23. Mr. Machen at the time of his retirement was chief engineer for the department in Manhattan.

Frederick F. McMinn (M. '35; F. '59), age 73, for sixteen years commissioner of buildings for Cincinnati, Ohio, died there recently. A graduate of the University of Cincinnati, he was design engineer and resident engineer with the Cincinnati Rapid Transit Commission prior to joining the Building Department in 1923 as chief engineer. He was assistant commissioner from 1927 to 1943, becoming commissioner in the latter year.

Arthur Leonard Mullergren (M. '28; F. '59), age 69, specialist in public utilities and natural gas engineering for over thirty-five years, died in Kansas City, Mo., on October 24. Before going into practice for himself in the early 1920's, Mr. Mullergren had been treasurer and captain of the construction division of the Benham Engineering Company, later Benham & Mullergren.

Walter Dow Myers (M. '48; F. '59), age 56, senior project engineer with the Pennsylvania Water and Power Company, at Allentown, Pa., died recently in Allentown. Shortly after graduating as a civil engineer from Clarkson College of Technology, Mr. Myers worked for the Aluminum Company of America. During his tenure with the company he worked as an hydraulic engineer in Russia and South America. In 1927 he left to join the Pennsylvania Water and Power Company, where he had charge of the design, construction and maintenance of hydroelectric projects. At the time of his death, Mr. Myers was serving as second vice president of the Lehigh Valley Section.

Lowell S. Rau (M. '58; F. '59), age 51, manager of the Structural Engineering Branch for Public Works, at the North Island Naval Base, San Diego, Calif., died at Riverside, Calif., on October 4. Earlier he was structural engineer for the New York firm of Voorhees Walker Foley & Smith. It was during this period that he initiated and directed design of an AEC pilot plant in the Savannah River area, for the experimental manufacture of hydrogen energy. He received his B.F.A. from the School of Architecture at Yale in 1939.

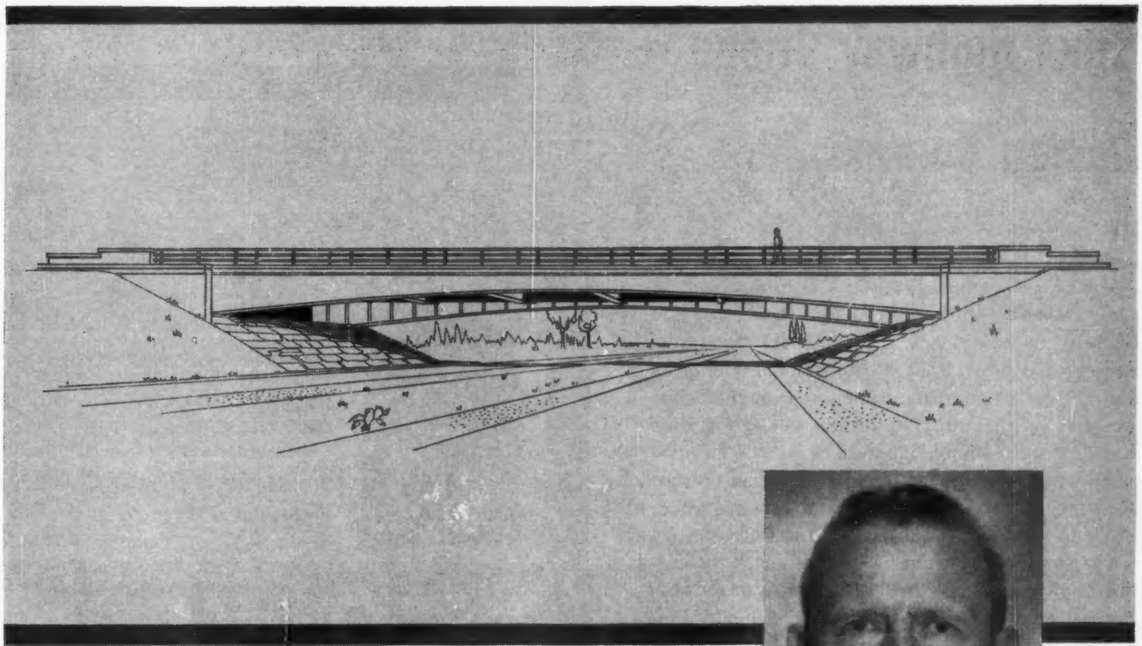
Walter Clifford Sadler (M. '24; F. '59), age 68, professor emeritus of civil engineering at the University of Michigan and a former mayor of Ann Arbor, Mich., died in Pacific Palisades, Calif., on October 14. Professor Sadler joined the University of Michigan faculty in 1925 as an assistant professor of civil engineering. In 1933 he was promoted to associate professor and in 1941 to full professor. He had extensive experience as an industrial and legal consultant and for his work as a legal counselor and engineer with the U.S. Army Corps of Engineers from 1941 to 1946 he received a Commendation Medal.

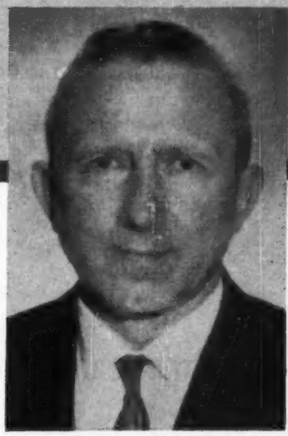
Frederick W. Scheidenhelm (M. '15; F. '59), age 75, New York City hydraulic and consulting engineer, died on October 18 in East Stroudsburg, Pa., where he had been on vacation. Mr. Scheidenhelm, who invented an anchoring wall for dams, was a consulting engineer on Montgomery Dam, built two years ago for Colorado Springs, Colo. His career included thirty years as consulting engineer to the American Electric Power Company. He organized the Pittsburgh Hydro-Electric Company, of which he was vice president and chief engineer, and was secretary-treasurer of the Scheidenhelm Construction Corporation. Mr. Scheidenhelm received his civil engineering degree in 1906 from Cornell University. In 1918 he received the ASCE Fitch Rowland Prize.

Isaac Yost Stauffer (M. '32; F. '59), age 72, retired engineer of Boyertown, Pa., died there recently. After graduating from Princeton University in 1909, he joined the Riter-Conley Manufacturing Company on steel erection. Later he was with the Standard Oil Company of New York and the Standard Vacuum Oil Company as operating and construction

(Continued on page 106)

This steel bridge design won $15,000



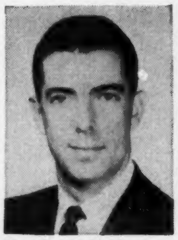


- Welded girder bridge
- Main span—160′—Total length—180′
- Concrete deck (composite action) 130 cu. yds.
- Steel weight—111 tons
  (58 tons Structural Carbon Steel
  53 tons USS TRI-TEN High Strength Steel)

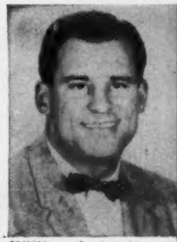
Allan M. Beesing, P. E.
555 South Street
East Aurora, N. Y.
1st Award $15,000
Professional Class

See following 3 pages for other winning entries in steel bridge design competition . . .

Douglas M. Fraleigh
5401 Bonnimae Way
Sacramento, Cal.



Marvin A. Shulman
4436 Morpheus Lane
Sacramento, Cal.



William Jurkovich
2170—56th Avenue
Sacramento, Cal.

2nd Honorable Mention $5,000 Professional Class

- Two-span welded girder bridge • Spans—80' • Total length—160'
- Concrete deck (composite action) 113 cu. yds.

- Wide flange beam bridge
- Main span—114'6"
- Total length—194'11"
- Concrete deck (composite action) 181 cu. yds.

3rd Honorable Mention $1,000 Professional Class

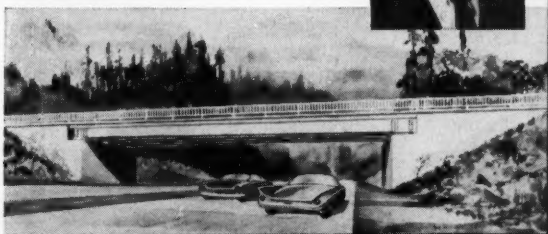
Tsu-Ming Yang
821½ W. Lawrence
Springfield, Ill.

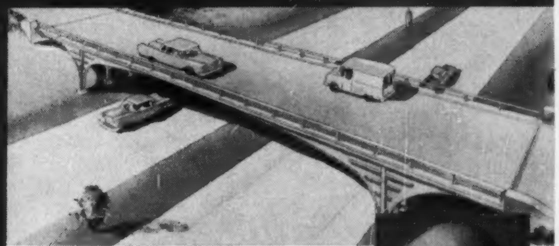
Muhittin Ozyurt
1414 Monument
Springfield, Ill.

- Beam bridge • Main span—112'
- Total length—124'6"
- 36" beams with fixed ends

Harry R. Powell
Smith Tower, Seattle 4, Wash.

3rd Honorable Mention $1,000 Professional Class

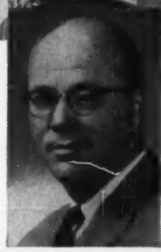


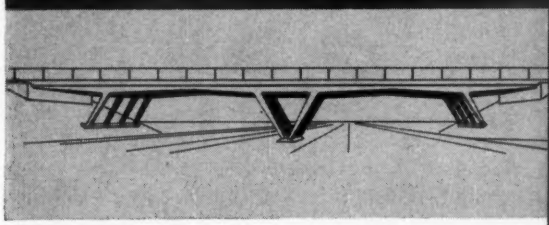


- Welded girder bridge
- Main span—124' • Total length—178'
- Concrete deck—131 cu. yds.
- Steel weight—92⅔ tons

Robert J. Prowse
65 High Street, Concord, N. H.

3rd Honorable Mention $1,000 Professional Class





- Welded two-span frame bridge
- Spans each 47' • Total length—162'
- Concrete slab—121 cu. yds.
- Steel weight—57 tons (USS TRI-TEN High Strength Steel)

Neils Jorgen Gimsing
Hattensens Alle 11, Copenhagen, Denmark

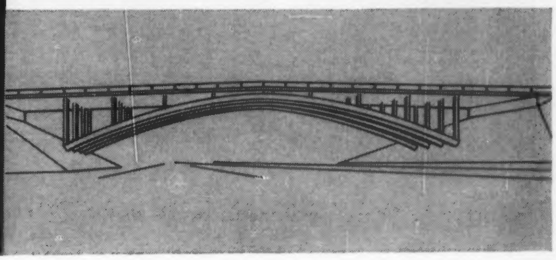
Hans Nyvold
Ulrikkenborg Alle 62, Lyngby, Denmark

1st Award $4,000 Student Class

- Welded-deck arch bridge
- Main span—144' • Total length—196'
- Deck 4¼" filled USS AmBridge I-Beam-Lok
- Steel weight—68 tons (high strength steel)

James C. Costello
21 Leeson Park, Dublin, Ireland

1st Honorable Mention $2,000 Student Class



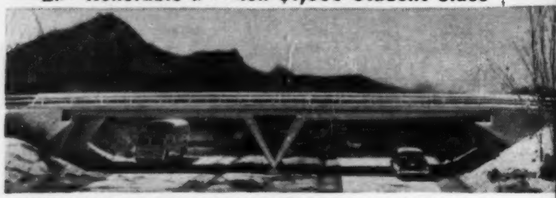
James A. Wood

Jack A. Berridge

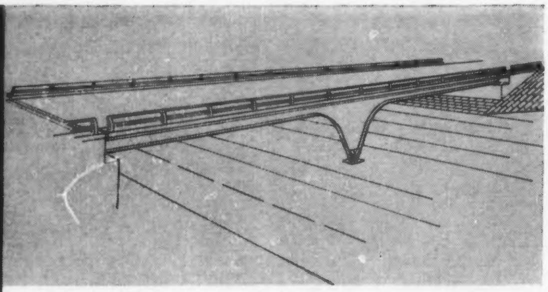
William O. Evers

Graduates of California State Polytechnic College

2nd Honorable Mention $1,000 Student Class



- Welded rigid-frame girder bridge • Two spans—each 57′
- Total length—114′ • Steel weight—52 tons
- Filled USS AmBridge I-Beam-Lok deck



- Welded girder bridge
- Two spans—each 66′
- Total length—132′
- 4¼″ filled USS AmBridge I-Beam-Lok deck
- Steel weight—43½ tons

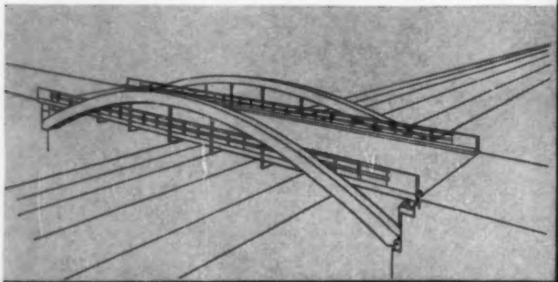
Harland C. Zenk
Truman, Minnesota

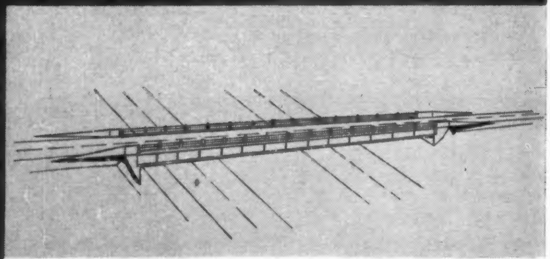
3rd Honorable Mention $500 Student Class

- Two-hinged arch bridge
- Span—149′4″
- Steel weight—85 tons
- Concrete deck—130 cu. yds.

Troy R. Roberts
Route 5, Neosho, Missouri

3rd Honorable Mention $500 Student Class





- Welded girder bridge
- Span—140′
- Deck 4¼″ filled USS AmBridge I-Beam-Lok
- Steel weight—145 tons

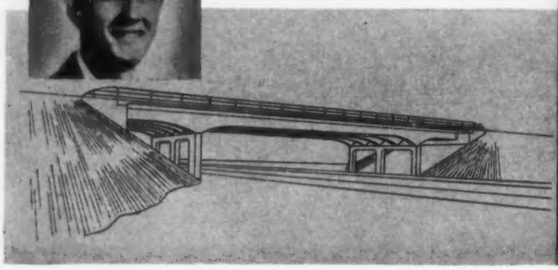
Joseph A. Yura
629 North 23rd St.
Allentown, Penna.

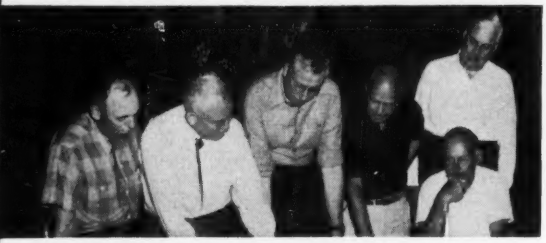
3rd Honorable Mention $500 Student Class

- Cantilever girder bridge
- Main span—120′
- Total length—180′
- Steel weight—103 tons
- Concrete deck—137 cu. yds.

Albert C. Knoell & Rodger K. Gieseke
Drexel Institute of Technology
Philadelphia, Penna.

3rd Honorable Mention $500 Student Class





THE JUDGES FOR THE COMPETITION WERE (left to right) **Dr. C. E. Webb,** Okemos, Michigan; **W. E. Jessup,** Past Editor of CIVIL ENGINEERING; **Leon Chatelain, Jr.,** Past President, A.I.A.; **C. P. Hazelet,** Hazelet & Erdal; **L. A. Post,** Executive Vice President, American Institute of Steel Construction; **Eugene L. Macdonald,** Parsons, Brinckerhoff, Hall & Macdonald.

For detailed description of all winning entries, write to American Bridge Division, United States Steel, 525 William Penn Place, Pittsburgh 30, Pa.

USS

American Bridge Division of United States Steel

Lehigh Mortar Cement "...helps the masons do a good job"

Architect: Hopkins & Burton, Baltimore, Md.
Contractor: The George Hyman Construction Co., Washington, D.C.
Dealer: Hudson Supply & Equipment Co., Washington, D

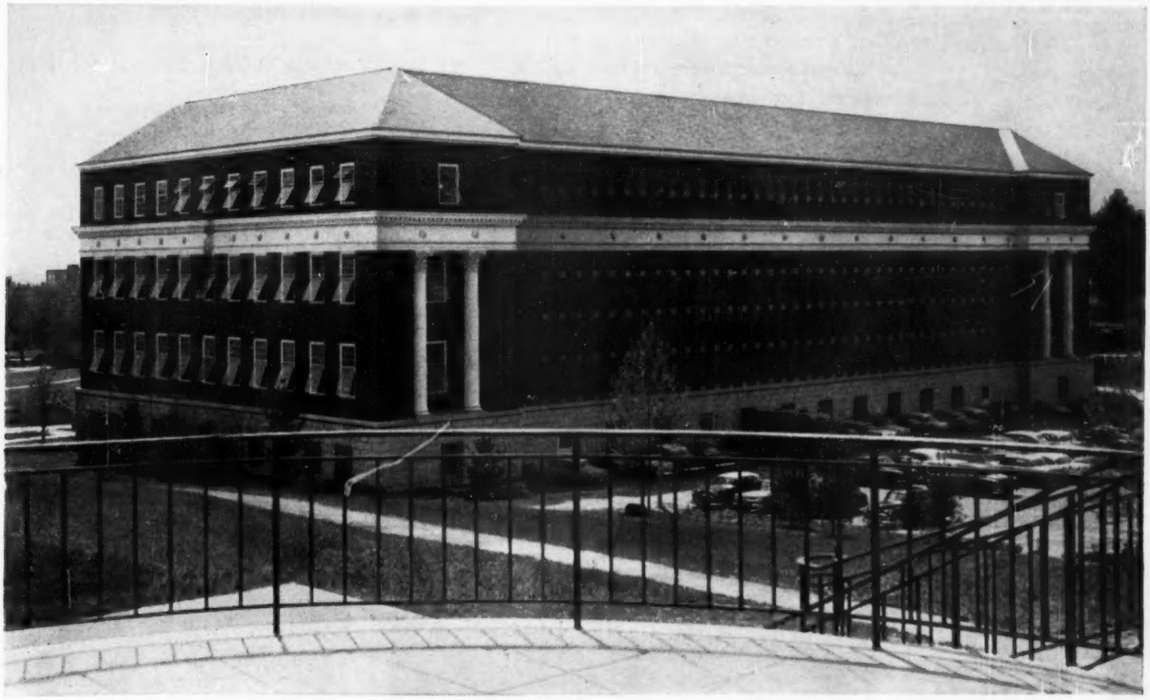
• The Theodore R. McKeldin Library is the latest of several large structures built on the University of Maryland campus by The George Hyman Construction Company. It clearly shows the results of good workmanship and good materials.

In commenting on the beautiful masonry walls of this library, Mr. J. A. Kopson, construction veteran of 50 years and superintendent on this job, had this to say about Lehigh Mortar Cement, "It has excellent strength, good color and its workability helps the masons do a good job."

This is typical of the comments made by users of Lehigh Mortar Cement the country over. So whether your next job is large or small, traditional or modern, try Lehigh Mortar Cement and see for yourself how it can help you build clean, strong, weathertight walls. Lehigh Portland Cement Company, Allentown, Pa.

- LEHIGH MORTAR CEMENT
- LEHIGH AIR-ENTRAINING CEMENT
- LEHIGH EARLY STRENGTH CEMENT
- LEHIGH PORTLAND CEMENT

LEHIGH CEMENTS



Rear view of Theodore R. McKeldin Library. The building has eight stories and basement. It is approximately 118 x 243 feet.

Deceased

(*Continued from page 100*)

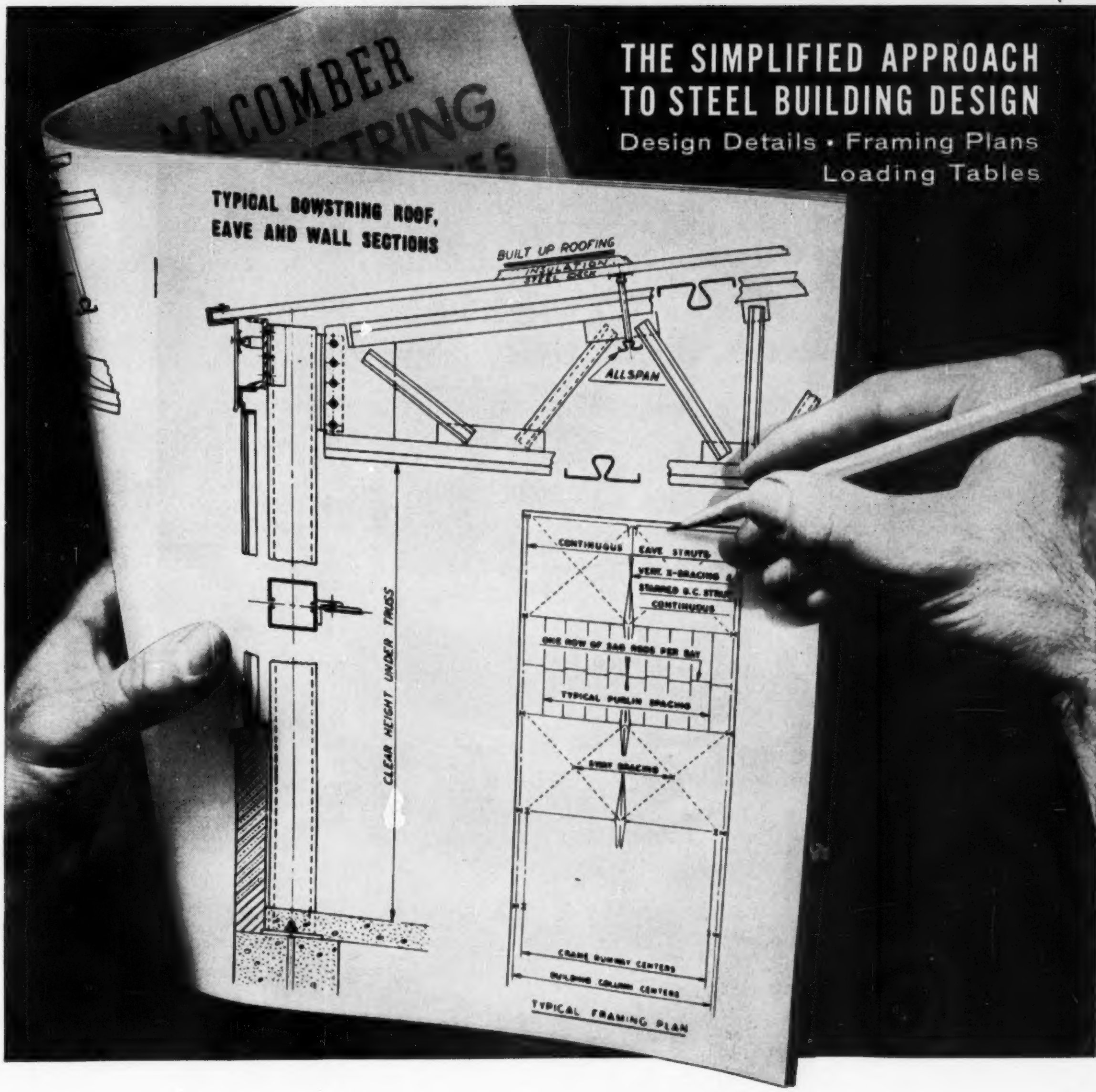
engineer. Mr. Stauffer retired from the latter companies in 1949.

Alton D. Taylor (M. '54; F. '59), age 54, assistant dean of engineering and head of the civil engineering department at Ohio Northern University, died in Ada, Ohio, on October 7. Professor Taylor joined the ONU staff as professor and head of the civil engineering department in 1954 after a career as an educator which went back to 1928, the year of his graduation from Renssalaer Polytechnic Institute. He taught at Rensselaer Polytechnic Institute, Colgate University (from which he received his A.M. in 1933), the University of Mississippi, Norwich University, Northwestern Technical Institute, and the University of Rochester.

Frank J. Trelease (M. '18; F. '59), age 72, pioneer builder of natural gas pipelines died in Oxford, Md., on October 2. He retired in 1947 as a senior consulting engineer with Ford, Bacon & Davis, Inc., after thirty-three years with the firm. Mr. Trelease was in charge of construction of the Lake Pontchartrain Bridge in Louisiana and, at the beginning of World War II, of the Electric Boat Corporation's submarine plant in Groton, Conn. During the war he was managing director of Maryland Research Laboratories, which Ford, Bacon & Davis operated for the Office of Scientific Research and Development. Mr. Trelease received a B.S. in civil engineering in 1908 and a civil engineering degree in 1913 from Washington University.

Francis K. Wai (A.M. '50; M. '59), age 45, civil engineer with the Honolulu Construction & Draying Company in Hawaii, died there recently. Upon receiving his B.S. in civil engineering from the University of Hawaii in 1936, he worked with the Territorial Highway Department and then with the Ready-Mix Concrete Company. For the past fourteen years he had been with the Honolulu Construction and Draying Company as civil engineer. Mr. Wai was a past president of the Hawaii Section.

Charles Smith Whitney (M. '24; F. '59), age 66, a partner in the firm of Ammann & Whitney, New York City consulting engineers, died in Paris on October 25. Mr. Whitney, whose firm was consultant for the design of the bridge that will span the Narrows between Brooklyn and Staten Island, was in charge of his company's contracts with Greece, Turkey, Ethiopia and Iran. Mr. Whitney was an authority on reinforced concrete structural design and had received civil engineering and master's degrees from Cornell University.


THE SIMPLIFIED APPROACH
TO STEEL BUILDING DESIGN
Design Details • Framing Plans
Loading Tables
MACOMBER
TYPICAL BOWSTRING ROOF,
EAVE AND WALL SECTIONS
BUILT UP ROOFING
ALLSPAN
CLEAR HEIGHT UNDER TRUSS
CONTINUOUS
EAVE STRUTS
TYPICAL PURLIN SPACING
TYPICAL FRAMING PLAN

New in Education

New dual-purpose joint facility laboratory . . . A dual-purpose laboratory for soil mechanics has been established as a joint facility by the *Illinois Institute of Technology* and the Armour Research Foundation. It will serve as a center for sponsored research and also as an instruction laboratory for undergraduate and graduate students. Dr. Eben Vey, F.ASCE, professor of civil engineering at Illinois Tech is university coordinator.

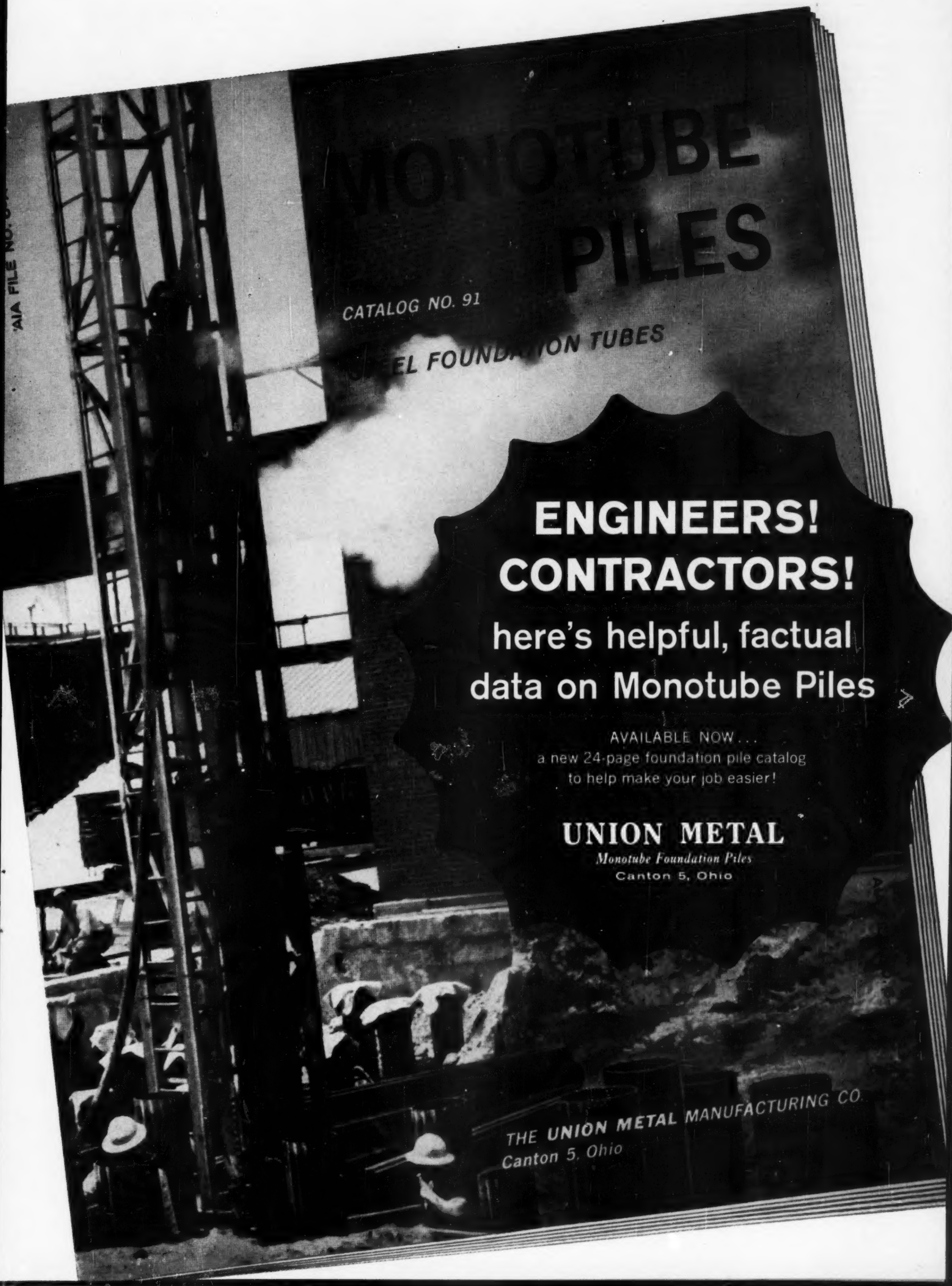
Winners in welding competition . . . Civil engineering undergraduates placed second and third in the 1959 James F. Lincoln Arc Welding Foundation Awards. Second place of $1,000 went to James Galinsky, of the *University of Illinois,* for his design of a welded hammerhead support, while Robert Silman, of *New York University,* won the third place prize of $500, for his design of a welded aluminum hyperbolic paraboloid roof structure. A similar undergraduate design competition is scheduled again this year. Closing date will be July 1, 1960. For those interested a rules booklet is available from the James F. Lincoln Arc Welding Foundation, Cleveland 17, Ohio.

Another swimming pool reactor . . . Work has begun on a $70,000 building at College Park to house the *University of Maryland's* 10 kilowatt "swimming pool" nuclear reactor, the first critical reactor in the state. When the critical reactor and related equipment goes into operation in the 1960-1961 school year, it will be part of the nuclear engineering training program initiated in 1954 under grants from the AEC and the State of Maryland. To date AEC grants have totaled $183,785.

ASCE members head university staff . . . Starting his second year as Head of the Department of Civil Engineering at the *University of Maine* is George K. Wadlin, Jr., A.M. ASCE. He succeeded Weston S. Evans, F.ASCE, who is now dean of the College of Technology at the university.

Fellowships in fluid mechanics . . . A Boris A. Bakhmeteff Research Fellowship (up to $3,000) will be available to a full-time graduate student who is a master's or doctoral candidate for the 1960-1961 academic year. Intended as a specific contribution for a definite research project in the field of fluid mechanics, study and research may be undertaken at an institution of the Fellow's choice. Applications should be filed by February 15, 1960 with Dean William Allan, School of Technology, The City College of New York, New York 31, N. Y.

University of Wisconsin in India . . . The engineering education project in India conducted for the past six years by the *University of Wisconsin* under the auspices of the U.S. government recently received a new contract. Approval of the new contract and acceptance of $580,500 will carry the project to December 31, 1961.


AIA FILE NO.
MONOTUBE
PILES
CATALOG NO. 91
ENGINEERS!
CONTRACTORS!
here's helpful, factual
data on Monotube Piles
AVAILABLE NOW...
a new 24-page foundation pile catalog
to help make your job easier!
UNION METAL
Monotube Foundation Piles
Canton 5, Ohio
THE UNION METAL MANUFACTURING CO.
Canton 5, Ohio

New Publications

Structural design . . . . For engineers concerned with the design of one- and two-story continuous structures, the American Institute of Steel Construction has prepared and published a practical reference, entitled "Plastic Design in Steel." To facilitate the designer's work, the 104-page manual contains a handy set of charts and formulas covering continuous beam and single- and multi-span rigid frames, and an economy table based on the plastic moment strength of rolled sections. The price is $4.00, and copies are available from the American Institute of Steel Construction, 101 Park Avenue, New York 17, N. Y.

Career guidance . . . . How to interest high school students in engineering as a career is the objective of two booklets recently released by the Iowa State University College of Engineering. One is a 34-page report of a seminar on engineering education, held at the university last May; the other is a 20-page discussion of engineering as a profession and of the courses needed for the study of engineering. Free copies are available while they last from the Dean of Engineering at Iowa State University, Ames, Iowa.

Soil survey in New Jersey . . . . The geology of the Newark, N. J., metropolitan area and the soil types associated with it are presented by Alfreds R. Jumikis, F. ASCE, in Research Bulletin No. 42 of the Rutgers University Bureau of Engineering. Engineering aspects and practical applications of soil surveys conducted in the area are included. The 72-page bulletin, priced at $1.50 a copy, is available from the Bureau of Engineering Research, Rutgers University, New Brunswick, N. J.

Highway construction . . . . Several new publications of considerable interest to civil engineers have recently been issued by the American Road Builders' Association. Among these are "Soil Cement for Farm-to-Market Roads in Alabama," (Tech. Bulletin No. 234) by Curtis Davis; "Cement-Treated Subbases for Concrete Pavements" (Tech. Bulletin No. 235) by Edward L. Kawala, A.M. ASCE; "Virginia's Experiments with Lime Stabilization" (Tech. Bulletin No. 236) by F. P. Nichols, Jr.; "Welded Wire Fabric Reinforcement in Asphaltic Concrete Overlays" (Tech. Bulletin No. 238) by Edward M. Howard; and "Lime Stabilization Expedites Construction of SAC Jet Runway" (Tech. Bulletin No. 239) by Ed Kreusel. All of the above Bulletins are available at a cost of 50 cents a copy. Technical Bulletin No. 237, a "Catalogue of Highway Construction Teaching Aids," can be purchased for $1.00 a copy. Orders for all bulletins should be sent to the American Road Builders' Association, World Center Building, Washington 6, D. C.

Man and his work . . . . "The Story of Man and His Work," a fascinating 32-page illustrated booklet published by the Du Pont Company, shows that "the American workman is a new kind of man living in a new kind of life." It points out that in the past few decades the growth of industrial technology has dramatically upgraded the worker's skills, living standards, and social status. Inquiries should be directed to the Public Relations Department, E. I. du Pont De Nemours and Company, Inc., Wilmington 98, Del.

Conservation . . . . Issuance of its annual publication on natural resources, entitled "Conservation and Use of Natural Resources," is announced by the Chamber of Commerce of the United States. The 65-page booklet discusses modern conservation practices and lists 22 sources of information on industrial resource development and management. The report was edited by Donald W. Van Tuyl, F. ASCE. Single copies are available from the Natural Resources Department, Chamber of Commerce of the United States, Washington 6, D. C.

Soil stabilization . . . . Two new technical bulletins have been released by the American Road Builders' Association. They are No. 242, entitled "Orange County Experiences with Soil-Cement Use," which sells for 50 cents, and No. 243, entitled "Lime Stabilization Construction Manual," priced at $1.00. Prepared by the ARBA Lime Stabilization Committee, the latter bulletin will be of special interest to engineers writing construction specifications. Both are available from the American Road Builders' Association, World Center Building, Washington 6, D. C.

Nuclear power costs . . . . An introduction to nuclear power costs is presented in a recent publication by Arnold Rachman. This monograph analyzes some of the factors which make up the total cost of nuclear power, and shows how variations in their value may affect the overall cost structures. It is one of a series on nuclear engineering subjects prepared for those requiring a broad understanding of the subject. Inquiries should be addressed to Simmons-Boardman Books, 30 Church Street, New York 7, N. Y.

Hydraulic research . . . . Availability of a Supplement to its 1958 "List of Publications" is announced by the U. S. Army Engineer Waterways Experiment Station. In addition to Experiment Station publications, the Supplement lists the reports published by the Beach Erosion Board, the Bonneville Hydraulic Laboratory, and the Los Angeles District Hydraulic Laboratory. The supplement is available from the Waterways Experiment Station (Vicksburg, Miss.) as a guide to ordering publications.

Highway safety . . . . To help professional drivers "who must constantly make decisions behind the wheel, alone and unaided," the National Safety Council has prepared a 20-page booklet, entitled "A Professional Code for Defensive Driving." Single copies of the pamphlet, which is called the "professional driver's safety code of the road," may be obtained from the National Safety Council, 425 North Michigan Avenue, Chicago 11, Ill.

Applications for Admission to ASCE, October 3-31, 1959

Applying for Member

(New Grade)

Philip Anderson Desmond Allsopp, Olympia, Wash.
Frank Aloysius Birnstein, Washington, D. C.
Ernest Worthington Blee, Long Beach, Calif.
John Frederick Brotchie, Berkeley, Calif.
Edward Oliver Busby, Madison, Wis.
William Franklin Busch, Harrisburg, Pa.
Robert James Caruso, Boston, Mass.
Ke Chieh Cheng, Taipei, Formosa
Donald William Chilton, New York, N. Y.
John Chester Cunningham, Omaha, Nebr.
Peter Louis Dito, Washington, D. C.
Edward Richardson Downs, Las Alamos, N. Mex.
John Edward Fritz, Houghton, Mich.
Jose Ignacio Garcia-Bengochea, Gainesville, Fla.
Roy William Gillette, Chicago, Ill.
Charles Franklin Greenleaf, Los Angeles, Calif.
George Joseph Halasi-Kun, New York, N. Y.
Forrest Holt Hall, Moscow, Idaho
Everett Albert Hansen, Galveston, Tex.
Itzchak Horowitz, Addis Ababa, Ethiopia
Billy Joe Howell, Beaumont, Tex.
Philip Bruce Keasey, Helena, Mont.
Thomas Jackson Keel, Savannah, Ga.
Arvids Kulitis, New York, N. Y.
George Newton Lathrop, Omaha, Nebr.
Reggie Millburn, Kowloon, Hong Kong
Harry Samuel Perdikis, Athol, Mass.
Nikolai Peterson, New Orleans, La.
Fernando Quiros, Los Angeles, Calif.
Sundaram Radhakrishnan, New Delhi, India
Roberts Louis Reins, Omaha, Nebr.
Abu Bakr Ali Rida, Atbara, Sudan
William Pryor Ringo, Jr., Miami, Fla.
Dan Sabo, Albuquerque, N. Mex.
Harold Sechster, New York, N. Y.
Albert Joseph Sanger, Lubbock, Tex.
Virendra Narottamdas Shah, Muscatine, Iowa
Robert Stephen Sherman, Greensboro, N. C.
Roy Edward Simonds, Massena, N. Y.
Sattadeva Narain Sinha, Washington, D. C.
Eugene Clifford Sprout, Sparks, Nev.
William Chapman Stookey, Fullerton, Calif.
James Marvin Stump, Philadelphia, Pa.
Charles William Stak, Girard, Ohio
William James Talbot, Jr., San Francisco, Calif.
John Charles Theiss, Jr., St. Louis, Mo.
Muhittin H. Tokoz, Ankara, Turkey
Basil Demetrios Vantsis, Athens, Greece
Charles Oscar Wamstad, Carson City, Nev.
Donald Nicholas Weinle, Westfield, Mass.
Thaddeus Wieczorek, New York, N. Y.

Applying for Affiliate

Martin Malinofsky, New York, N. Y.

Applying for Associate Member

(New Grade)

Billy Gene Crockett, Port Hueneme, Calif.
Emmo Folko Antonius Strahal, Buenos Aires, Argentina

Applying for Associate Member

(Old Grade)

Jagdish Lal Ajmani, Ithaca, N. Y.
Daniel Joseph Barnes, Los Altos, Calif.
Radwan Sa'id Bekowich, Olympia, Wash.
James Chandler Buzzell, Jr., Orono, Me.
Yew-Choy Chong, Los Angeles, Calif.
Bernard Anthony Donnellan, Champaign, Ill.
Ronald Stewart Hunter Duncan, Lakeland, Fla.
Jorge Enrique Falla Lozano, Washington, D. C.
Frank Maurice Field, Los Angeles, Calif.
Walter Christian Grantz, New York, N. Y.
Hidayat Niyazi Grouni, Lafayette, Ind.
William Ferdinand Jebb, Walla Walla, Wash.
Taavi Kaups, Chicago, Ill.
Gerald Samuel Kovacs, Los Angeles, Calif.
Eduardo Keygier Silverberg, Havana, Cuba
Roger Lee Lapp, Kansas City, Mo.
Augusto Chiossone Lares, Caracas, Venezuela
Lauren Albert Larsen, Minneapolis, Minn.
Arthur Chadeayne Lee, Jr., Lajes Field, Azores
William George Lehne, Paterson, N. J.
Frank Joseph Linville, San Francisco, Calif.
Christopher Yue-Wei Ng, Storrs, Conn.
August Henry Niemann, Los Angeles, Calif.
Thomas John O'brien, Gunnison, Colo.
Antranig Michael Ouzoonian, New York, N. Y.
Ronald Earl Pelkey, Urbana, Ill.
Roger Eugene Plumb, Milwaukee, Wis.
Mohammad Abdul Qadir, Chicago, Ill.
Lino Quirko, New York, N. Y.
Kotha Koteswara Rao, Iowa City, Iowa
Robert Nelson Robertson, Austin, Tex.
Vishnubhotla Vasudeva Sastry, Urbana, Ill.
Robert Clifton Schwerke, North Miami Beach, Fla.
Mohammad Salah Eldin Shalash, Munchen, Germany
Divakarla Sitharama Sharma, Hyderabad, South India
Tenner Marcus Tangen, Minneapolis, Minn.
Sim Bee Teck, Morse Road, Singapore
Daniel Benoliel de Carvalho Vera-Cruz, Lisboa, Portugal
John Tedd Webster, Los Angeles, Calif.
Frank Thomas Wilkin, Vancouver, B. C., Canada
Alan Stockbridge Winter, Chicago, Ill.
Elias Zolkov, Haifa, Israel

[Applications for the grade of Associate Member from ASCE Student Chapter Members are not listed.]

Non-ASCE Meetings

American Institute of Consulting Engineers. Winter meeting at the Statler Hilton Hotel, New York, N.Y., January 31-February 5. For advance information write to the American Institute of Consulting Engineers, Engineering Societies Building, 33 West 39th Street, New York 18, N.Y.

American Institute of Mining, Metallurgical and Petroleum Engineers. Annual convention at the Statler Hilton and Sheraton-Atlantic Hotels, New York, N.Y., February 14-18. Information from the American Institute of Mining, Metallurgical and Petroleum Engineers, 29 West 39th Street, New York 18, N.Y.

American Road Builders' Association. Fifty-eighth annual convention in Cincinnati, Ohio, January 18-21. Address queries to Randy Russell, Public Relations, American Road Builders' Association, World Center Building, Washington 6, D.C.

American Association for the Advancement of Science. Annual meeting at the Hotel Morrison, Chicago, Ill., December 26-31. The program can be secured in advance from the American Association for the Advancement of Science, 1515 Massachusetts Avenue, N.W. Washington, D.C. by payment of a $3.00 fee, or at the meeting by registration at the Morrison Hotel.

Associated Equipment Distributors. Forty-first annual meeting at the Conrad Hilton Hotel, Chicago, Ill., January 24-28. Hotel reservations and registration forms may be had by writing to the Associated Equipment Distributors, Convention Department, 30 East Cedar Street, Chicago 11, Ill.

Highway Research Board. Thirty-ninth annual meeting at Sheraton-Park Hotel, Washington, D.C., January 11-15. For further details write to Fred Burggraf, Director, Highway Research Board, 2101 Constitution Avenue, Washington 25, D.C.

National Swimming Pool Institute. Convention and exposition at the Coliseum and Statler-Hilton Hotel, New York, N.Y., December 12-15. Address queries to the National Swimming Pool Institute, Harvard State Bank Building, Harvard, Ill.

(Continued on page 121)

Progress Report on STEEL CONSTRUCTION

DECEMBER 1959

BETHLEHEM STEEL

BETHLEHEM FABRICATED STEEL CONSTRUCTION

For all credits, please see last page

Sixty Stories of Steel

NEW YORK CITY—Here is the steel framework for one of the premier buildings of our time. It's The Chase Manhattan Bank Building, the largest office building constructed anywhere in twenty-five years, and now one of the city's architectural landmarks.

We are preparing an abundantly illustrated booklet describing the substructure and superstructure steelwork for Chase Manhattan. If you would like to have a copy, write to Publications Department, Bethlehem Steel Company, Bethlehem, Pa.

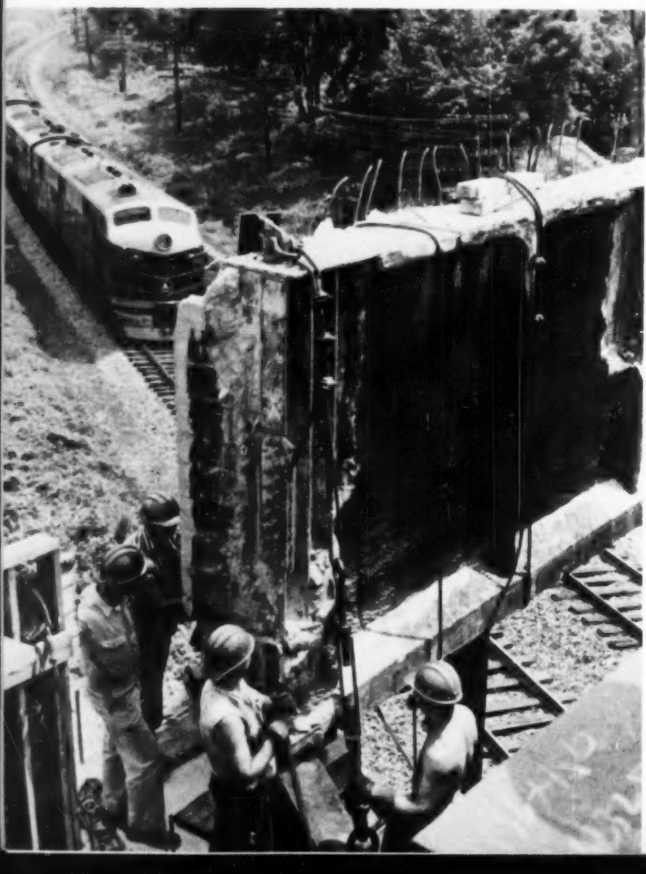
Another Mississippi River Crossing

DAVENPORT, IOWA—Old Glory flapped briskly in the breeze as Bethlehem bridgemen eased the closing truss for the Iowa-Illinois Memorial Bridge into place on August 7. The truss, measuring 53 ft in length and 14 ft deep, and weighing 8 tons, was picked from a barge on the Mississippi River by a water-borne 50-ton-capacity stiffleg tower derrick.

The new bridge is virtually identical to the well-known Davenport Bridge immediately adjacent to it, designed by the same engineering firm, and completed by Bethlehem in 1935. Completion of the new crossing late this year will permit one-way traffic on each bridge, doubling vehicular capacity.

The overwater section of the bridge is 3,370 ft, including a 1,480-ft main suspension span. Total length between abutments is 5,017 ft. Approach spans are of continuous-beam, through-truss, and deck-truss design.

Approximately 5,250 tons of steel for the Memorial Bridge were fabricated at our Rankin, Pa., and Chicago works; the bridge strand and hangers for the suspended span at our Williamsport, Pa., Plant.



How to Stretch a Bridge

WASHINGTON, D.C.—A B&O train rumbles below as Bethlehem bridgemen wrestle an 80-ton plate girder into a new position on falsework. The project is the widening—to six lanes—of a 25-year-old four-lane plate-girder bridge on New Hampshire Avenue.

The two outer girders of the existing bridge, though still sound, were too deep to remain in their present position (they would project 1½ ft above the roadway). And they couldn't, of course, be simply trimmed down. So it was decided to move them outboard, replacing them with new steel.

To accomplish this, the contractor first performed such functions as preparing new bridge seats and stripping away concrete paving, curbs, sidewalks, and parapets. Falsework was erected to take the load until new girders were placed.

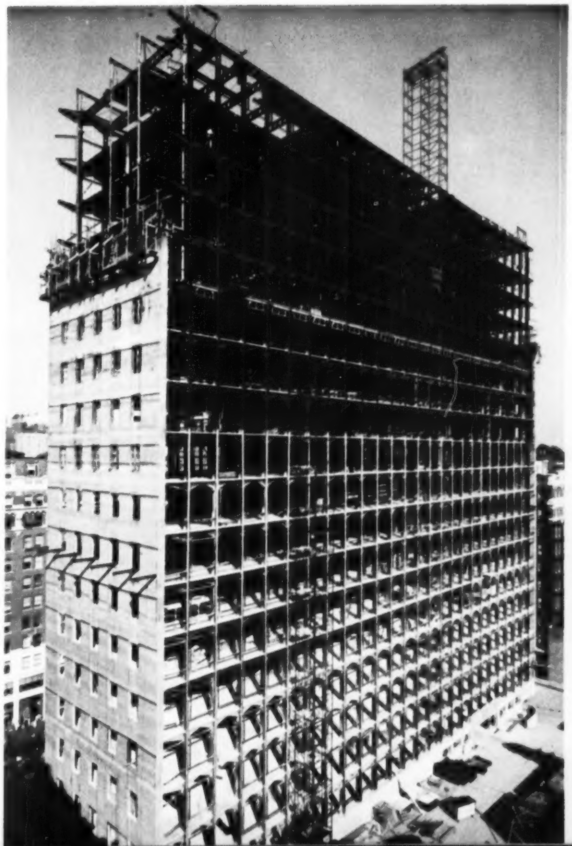
Then Bethlehem crews disconnected the old girders, jacked them out to their new positions, placed new girders, floor beams, and stringers, and made all necessary connections. Bethlehem's share of the job took only eight days—during which the two inner lanes of the bridge were open to traffic.

Topping Out
22 Stories in Seattle

SEATTLE—One of the biggest office buildings ever constructed in the Northwest is the Washington Building, the 22-story major structure of the Metropolitan Center. A project of the University of Washington's University Properties, Inc., the center will include a post office building and a seven-level parking garage.

Shown here at about the time of topping out, the structure presents an interesting pattern of steel. Note particularly the tapered spandrel beams. Half-sections of these beams were connected to two-tier column sections at our Seattle works, forming fabrications resembling the Cross of Lorraine. When positioned, the spandrel beams were then connected at their mid-points.

Joists supporting the poured-concrete floors are notable for their hexagonal cut-outs, as can be seen in the upper left of the photo. This reduced the weight of the beams by 50 per cent, and permitted the passage of utilities.



Atlanta Plant for Crown

ATLANTA—This job presented two challenges to Bethlehem. One was to erect the steelwork in a hurry. The other was to handle the fabrication of numerous roof ventilators in the field rather than in the fabricating shop.

The project is a huge new can, crown, and closure plant of Crown Cork and Seal Company. Its main manufacturing area measures 540 x 420 ft, all 31½ ft high. It's laid out in 30 x 60-ft bays, spanned by 60-ft trusses fabricated at our Pottstown, Pa., works. Lower structures on three sides house administrative, shipping, and other offices. These areas are spanned with bar joists, also made at Pottstown. The entire structure is high-strength bolted.

The flexibility of steel construction is well illustrated by the on-the-site fabrication referred to earlier. With relative ease we were able to fabricate the bents and connections for more than eighty ventilators. Bolt holes were drilled in the framing beams, and the structures were erected.

Another major addition to the amazing industrial growth of Atlanta, the plant is at the city line near Hapeville, adjacent to the airport and just off the heavily travelled Southeast Expressway.

Smooth Work over White Water

NIAGARA FALLS—Far out over the swirling Niagara River goes a section of a plate girder. It is being swung into position on a temporary steel "island" support. The piece weighs 59 tons, is 96 ft long, and varies in depth up to 12 ft. It's being handled by a stiffleg derrick of 85-ton capacity. The safety net, a "must" in this case, would save a bridgeman from a sure-fatal plunge over the Falls, downriver from the bridge site.

The completed bridge will boast the longest main span of any bridge of its type in the nation—450 ft. Total length with sidespans is 590 ft. It will also be one of the shallowest bridges of its type, having a midspan depth of only seven feet.

When completed, the span will handle all vehicular traffic to Goat Island, a favorite vantage point for sightseers. It's part of an extensive project calling for development of a river-front parkway and expansion of tourist facilities on the island and on the mainland near the Falls.

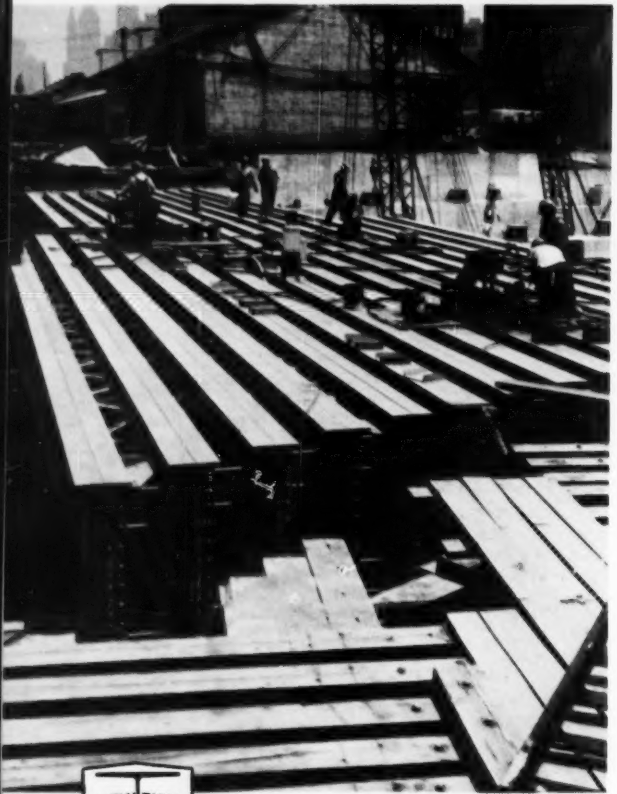
BETHLEHEM STEEL

Saddling Up

BRONX, N. Y.—At the dizzying height of 350 ft above the waters of the East River Bethlehem crewmen early in September placed the suspension cable saddles for the Bronx-side tower of the Throgs Neck Bridge. Shortly thereafter the operation was duplicated for the Queens-side tower, marking an important milestone in construction of this major new bridge.

Scheduled for completion in 1961, the bridge will extend 11,070 ft including elevated approaches, its main suspension span being 1,800 ft. Total cost is estimated at $90 million.

Another important Bethlehem contribution will be construction of the bridge approach viaducts in Queens on Long Island. Motorists in this area will, when the bridge is in operation, have speedy access to the Bronx and thence to New England and upstate New York.



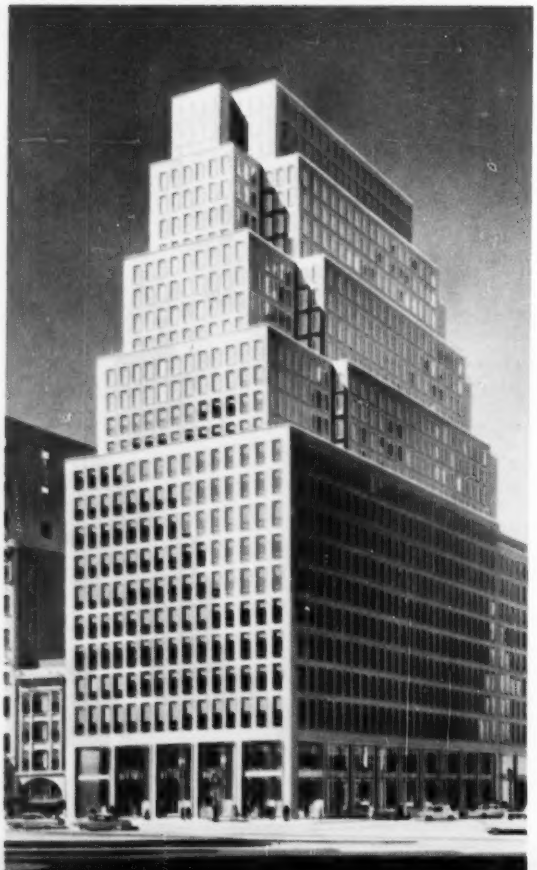
Building a Highway Under
. . . 21 Railroad Tracks
. . . 2 Freight Houses
. . . 2 Freight Driveways
. . . 1 City Street

CHICAGO—It isn't an easy job. Among other things it requires one of the heaviest concentrations of structural steel ever designed for highway construction. The project is a railroad grade separation between West Wayman and West Kinzie streets in downtown Chicago, to permit the flow of Northwest Expressway traffic under one of the city's biggest and busiest railroad freight yards.

The heavy girders shown being placed by Bethlehem crews are a few of two hundred and fifty-seven, varying from 76 to 80 ft long, 6 to 9 ft deep, and weighing from 20 to 50 tons. They add up to 7,200 tons for the 700-ft-long structure. Their erection entails the solution of a multitude of problems, the primary requirement being to avoid disturbing normal yard activities.

The work of the general contractor includes excavating under tracks, supporting them on wooden trestles, and constructing concrete abutments and piers. Then, when railroad service permits, tracks are removed, the girders and steelplate deck are quickly installed, and the tracks returned to their original positions.

BETHLEHEM STEEL



New Life for an Old-Timer

NEW YORK CITY—Here is the future new face of the 63-year-old building housing the Fifth Avenue Office of Morgan Guaranty Trust Company of New York, located at 44th Street and Fifth Avenue. Its basic 12-story structure is still there, topped by another 12 floors of steel framing and faced with modern curtain walls.

Expansion of the existing building was planned by Guaranty Trust Company well before its merger with J. P. Morgan Co., Inc., last April. The method of alteration chosen was found to be more economical from a real estate operating and management point of view than constructing an entirely new building. However, it posed a multitude of problems for the designers and contractors.

One primary consideration lay in the fact that twenty-four of the old columns were incapable of taking triple their original loadings. This is being remedied by removing those columns and their foundations and replacing them with new steel. This delicate and complex job, subcontracted to Bethlehem, required probably as ingenious an erection scheme as has ever been worked out for building construction.

With husky new columns in place, Bethlehem crews will erect the top twelve levels in the conventional manner. More than 4,400 tons of steel, fabricated at our Pottstown, Pa., works, are required for the entire project.

Site With a View—For Men of Vision

BETHLEHEM—On the very crest of South Mountain, 700 ft above the Lehigh River, Bethlehem Steel's new research laboratories are rapidly taking shape. The site is less than a mile from Bethlehem's headquarters building and "home" plant, which stretches four miles along the banks of the river. The site commands a spectacular view of the entire Lehigh Valley to the north and the Saucon Valley to the south.

At center-left is the framework for a 242 x 96-ft shop, warehouse, and structures-testing building, which features a unique roof-supporting system of steel-pipe trusses. At right is the administration building, which includes a bench-scale laboratory wing, shown in closer detail in the accompanying photo.

The full magnitude of the multi-million dollar project can better be comprehended when it is understood that the extensive work shown here represents only 20 per cent of the entire project!

An unusual architectural fillip is the wavy contour of the fascia of the administration building.

CREDITS . . .

The Chase Manhattan Bank Building	*Architect:* Skidmore, Owings & Merrill; *consulting foundation engineer:* Moran, Proctor, Mueser & Rutledge; *consulting structural engineer:* Weiskopf & Pickworth; *general contractor:* Turner Construction Company; *foundation contractor:* The Foundation Co., George M. Brewster & Son, Inc., and Joseph Miele Construction Co., Inc.
Iowa-Illinois Memorial Bridge	*Owner:* Davenport Bridge Commission; *engineer:* Modjeski & Masters.
New Hampshire Avenue Bridge	*Engineer:* Modjeski & Masters; *general contractor:* S. T. G. Construction Company, New York City.
Washington Building	*Architect:* Naramore, Bain, Brady & Johanson; *structural engineer:* Worthington & Skilling; *general contractor:* Lloyd W. Johnson and Morrison-Knudsen Co., Inc., a joint venture.
Crown Cork & Seal	*Architect and engineer:* Robert and Company Associates; *builder:* McCloskey Enterprises, Inc.
American Rapids Bridge	*Owner:* Power Authority of the State of New York; *design engineers:* Praeger-Kavanagh.
Throgs Neck Bridge	*Owner:* Triborough Bridge & Tunnel Authority; *engineers:* Ammann & Whitney for the suspension bridge; E. Lionel Pavlo for the approach viaducts; *consulting architects:* Aymar Embury II, A. Gordon Lorimer, John B. Peterkin, and Theodore J. Young.
Chicago Railroad Grade Separation	A project of the Bureau of Engineering of the Department of Public Works, City of Chicago, in cooperation with the Illinois Division of Highways, the Cook County Department of Highways, and the Bureau of Public Roads; *general contractor:* Kenny Construction Company.
Morgan-Guaranty Trust Building	*Architect:* Eggers and Higgins; *structural engineer:* Weiskopf & Pickworth; *mechanical and electrical engineer:* Cosentini Associates; *general contractor:* Turner Construction Company.
Bethlehem Steel Research Laboratories	*Architect:* Voorhees Walker Smith Smith & Haines; *consulting engineer and landscape architect:* Clark & Rapuano; *general contractor:* Turner Construction Company.

LITERATURE AVAILABLE—FREE OF CHARGE

Booklet 482—Building The Greater New Orleans Bridge. Describes construction of the superstructure for the nation's longest cantilever highway bridge.

Booklet 454—Building the Walt Whitman Bridge. The picture-story of construction of a major suspension bridge over the Delaware River at Philadelphia.

Booklet 495—High-Strength Bolting for Structural Joints. A 1959 revision of our 24-page booklet describing and illustrating the use of high-strength bolts for structural applications.

Catalog S-58—Bethlehem Structural Shapes. Contains data and tables useful to designers.

Booklet 503—Building a Giant Water Line. Describing the field erection of a 14-ft-diam, all-welded, above-ground flow line.

Booklet 127C—Typical Installations of Bethlehem Steel Sheet Piling.

Catalog 223—Bethlehem H-Piles. A comprehensive catalog on the subject.

Catalog 433—Bethlehem Steel Sheet Piling. Dimensions, properties, and specifications.

Address your request to Publications Department, Bethlehem Steel Company, Bethlehem, Pa.

Export Distributor: Bethlehem Steel Export Corporation

BETHLEHEM STEEL

Booklet 539

5911, Printed in USA

Non-ASCE Meetings

(Continued from page 112)

New York State County Highway Superintendents' Association. Winter meeting at the DeWitt Clinton Hotel, Albany, N.Y., January 27-29. Address requests for information to Harry R. Mason, Secretary, New York State County Highway Superintendents' Association, Fonda, N.Y.

Society of Plastics Engineers. Sixteenth annual technical conference at the Conrad Hilton Hotel, Chicago, Ill., January 12-15. A preliminary program and advanced information from the Society of Plastics Engineers, Inc., 65 Prospect Street, Stamford, Conn.

University of Illinois. Second sanitary engineering conference co-sponsored by the State Department of Public Health and the University's Department of Civil Engineering. Information concerning the program and hotel facilities available from William J. Downer, Assistant Chief Sanitary Engineer, Department of Public Health, Springfield, Ill.

Positions Announced

International Cooperation Commission. Wanted a general water geologist or hydraulic engineer competent in ground water geology to assist and advise officials of the Government of Sudan in developing a program of ground water resources and formulation of planning to govern drilling operations and to supervise ground-water geology project and canal-lining for irrigation system. Apply to Box G-1, Office of Public Health, International Cooperation Administration, Washington 25, D.C.

Department of the Navy. Openings exist for a college professor, GS-1710-12, at $8,330 per annum, and a structural engineer, GS-11, at $7,510 per annum. Both jobs will be with the U.S. Naval Construction Battalion Center, Port Hueneme, Calif. Applicants for the position of college professor must have had experience of sufficient scope to instruct Civil Engineering Corps Officers in the administration of construction contracts, public works management, naval construction forces, passive defense and engineering management. The structural engineer will be responsible for the development and preparation of Federal and military specifications and standards carried out by the Material Department of the Standardization Division. In addition to an engineering degree from an accredited university, applicants for the latter position must possess at least three years professional engineering experience, one year of which must have been specialized. Applicants for both positions should forward Standard Form 57 to Code 12C11, Placement Section, Industrial Relations Office, Construction Battalion Center, Port Hueneme, Calif.

ENGINEERING SOCIETIES PERSONNEL SERVICE, INC.

(Agency)

New York 8 W. 40th ST.	CHICAGO 29 E. MADISON ST.	SAN FRANCISCO 57 POST ST.

These items are listings of the Engineering Societies Personnel Service, Inc. This Service, which cooperates with the national societies of Civil, Electrical, Mechanical, Mining, Metallurgical and Petroleum Engineers, is available to all engineers, members or non-members, and is operated on a non-profit basis. If you are interested in any of these listings, and are not registered, you may apply by letter or resume and mail to the office nearest your place of residence, with the understanding that should you secure a position as a result of these listings you will pay the regular employment fee of 5 percent of the first year's salary if a non-member, or 4 percent if a member. Also, that you will agree to sign our placement fee agreement which will be mailed to you immediately, by our office, after receiving your application. In sending applications be sure to list the key and job number.

When making application for a position include 8 cents in stamps for forwarding application to the employer and for returning when possible.

Positions Available

TEACHING PERSONNEL, civil graduates with at least an M.S. degree, with graduate and undergraduate teaching experience. Salary open. Location, Near East. F 8049.

SOILS ENGINEER, C.E., about 25. Graduate or one year's experience in soils and concrete tests, including field, lab and report writing, together with potential management ability, for consultant. Recent graduate should have some special courses in soils and definite interest in the type of work. Starting salary, $5,400 a year. Employer pays placement fee. Location, Southern California. S(P)-4804.

CONSTRUCTION ENGINEER, mature, with broad background in construction, including experience with large steel structures. Must have record of success in responsible positions both as to technical and administration capabilities. Will direct team of structural, mechanical, electrical, electronics and civil engineers and technicians in the inspection of the construction of a unique research facility. Must be U.S. citizen. Salary open. Location, Middle Atlantic State. W 7985.

SAFETY ENGINEER, civil or mechanical graduate, with at least five years of field engineering experience including safety and protection work in general building, public works and heavy construction fields. Salary, $8,000 a year. Location, New York. W 7987.

HIGHWAY ENGINEERS. (a) Senior civil engineer, highway, N.Y. State Professional Engineers license or eligible for license, with six years of responsible experience in civil engneering, two of which must have been in the design of major highway projects; and two additional years in either design or supervision of construction on such projects. Salary, $7,580-$9,740 a year. (b) Assistant civil engineer, highways, N.Y. State Professional Engineers license or eligible for license, garduate civil, with three years of field and office experence in civil engineering, one of which must have been in the design of highways and appurtenances. Salary, $6,230-$7,900 a year. Location, New York Metropolitan area. W 8002.

SENIOR CIVIL ENGINEER, structures, B.S. or M.S. in civil engineering, N.Y. State Professional Engineers license, or eligible for license, with from five to six years of experience, three of which must have been in the design of structures and one in supervision of construction of such projects. Design and supervision of construction must have been in connection with sewage treatment plants, bridges or public buildings. Salary, $7,580-$9,740 a year. Location, New York Metropolitan area. W 8003.

CIVIL ENGINEER, either a recent graduate or one with less than five years of experience, for work in office and field. Salary good; opportunity for advancement. Location, New York State. W 8027.

JUNIOR CIVIL ENGINEERS, degree, for design and layout of industrial process buildings and equipment. Location, West Virginia. W 8036.

SENIOR SANITARY ENGINEER, preferably with a Masters' in sanitary engineering, P.E. license desirable, with a least four years of experience, to handle design of sewerage systems and treatment plants; knowledge of water systems. Salary commensurate with experience and capabilities; fringe benefits. Location, Connecticut. W 6613.

DESIGNER-DRAFTSMAN, C.E., with California License preferred. Well experienced in preparation of designs and drafting of layouts and details of industrial and multi-story buildings for architectural office. About $8,400 a year, San Francisco. S(P)-4818.

PLANT OPERATIONS ENGINEERS, graduate civil engineers, to 40; must have practical experience in all phases of concrete engineering, such as materials, redi-mix plant operations, quality control, etc. Good opportunity with progressive company. Employer will negotiate placement fee. Salary, $6,600-$9,000 a year. Location, Chicago area. C 7765.

This is only a sampling of the jobs available through the ESPS. A weekly bulletin of engineering positions open is available at a subscription rate of $3.50 per quarter or $12 per annum for members, $4.50 per quarter or $14 per annum for non-members, payable in advance.

RECENT GRADUATE ENGINEERS, either mining or civil, with courses in geology, for prospecting and exploration relating to industrial minerals. Substantial portion of time to be spent in the field. Location, South. W 8037.

CIVIL AND HYDRAULIC ENGINEERS. (a) Supervising engineer, graduate civil; should have, or be able to get, Professional Engineers license in New Jersey; four years of experience in engineering work involving either flood control or ground water hydrology, open channel hydraulics, water supply and/or flood control, including one year of supervisory experience. Thorough knowledge of structural stability and hydrologic and hydraulic computations required. Salary, to start, $7,369 a year. (b) Assistant engineer, hydraulic, under 35, graduate civil, and at least one year of experience in engineering work involving preferably ether flood or ground water hydrology, open channel hydraulics, water supply and/or flood control. Duties initially, will be in the field of open channel hydraulics. Salary, to start, $4,750 a year. Location, New Jersey. W 8101.

ASSISTANT BUILDING INSPECTOR, graduate in civil or structural engineering, with about one year's experience in inspection or construction of buildings and structures. Will assist in examining plans and applications for new buildings, building alterations, signs, air conditioning systems, etc., for compliance with Building Code, Zoning and other ordinances. Location, northern New Jersey. W 8126.

STRUCTURAL DESIGNER, B.S.C.E., to 50. Four years of experience on structural design in steel and concrete structures. Duties include design of industrial structures, power plant buildings, water and sewage treatment plants, dock facilities, for a consulting engineer. Salary, to $8,400 a year. Location, Louisiana. C 7773(c).

SOILS ENGINEERS (a) Graduate, young, with 0-2 years' experience in lab and field making calculations, testing compactions, taking field samples for consulting engineering service. $5,400-$6,000 a year. (b) eight to ten years of soils engineering experience. Able to layout field, office and lab work for assistants to collect, analyze and prepare reports on soils conditions and problems in compactions, foundations, materials, investigations, for a consultant. $8,000 up a year. San Francisco. S(P)-4798.

OFFICE ENGINEER, C.E., age 25-35. Field drawings, changes, costs, records on boiler house job for pulp mill. $6,600-9,000 a year. About one and one-half years. Employer pays placement fee. Location, Northwest. S(P)-4790-R.

SENIOR DESIGN ENGINEER, C.E. or M.E., age 25-45. Five years of experience preferably in mine to perform duties as assigned by chief construction engineering relating to design of foundations for equipment drawing of equipment modifications and supervision of field installation of equipment for uranium mining and milling company. Will consider applicant with less experience at less salary. $7,300-8,400 a year. Location, New Mexico. S(P)-4786-R.

CIVIL ENGINEER, C.E. plus California Registration. Minimum four years of experience in responsible charge of design and construction. Responsible for plans, drawings, specifications, estimates, reports on street, water system, sewer lines, treatment plants; for municipality. $9,000-11,100 a year. Location, San Francisco East Bay. S(P)-4775.

CONSTRUCTION ENGINEER, C.E., young. Several years of heavy construction field experience involving civil or mechanical installation (foundations for buildings or equipment, general heavy mill type building) for gypsum mine, board plant and plaster mill. Should have supervisory experience and be able to carry out field layouts, surveys and deal with contractor and subcontractors. To $8,400 a year. Location, Nevada. S(P)-4774-R.

ESTIMATOR, civil engineering background, to age 45. Experienced in takeoff, prices, assembling, etsimates, for general contractor's bidding on highways and freeways. For general contractor. Must be fast, accurate and completely informed regarding whole bid process with a knowledge of vendor specifications, able to read and interpret specifications and blueprints. $7,200 a year for minimum experience; to $9,000-12,000 a year for good experience. Location, San Francisco. S(P)-4773.

ASSISTANT DIRECTOR OF PUBLIC WORKS, C.E., plus California Registration, age open. Minimum six years of professional experience, of which three should be in administration of labor forces. Requires high management engineering capacity and ability to work with supervisory board and department heads as job involves responsibility for roads, bridges, county building construction and maintenance, codes, subdivisions, and related experience in contracts, specifications, inspection, public work engineering and building necessary. U.S. Citizen. $10,000-13,200 a year and up. Central California. S(P)-4759.

Men Available

CIVIL ENGINEER, A.M. ASCE, B.C.E., age 29, registered professionally in Ohio. Two years' experience in contract administration and inspection as owner representative; and three years' experience in large building construction as project engineer, and assistant superintendent. Desires position with opportunity in management or administration. Location desired, East Coast. C-499.

PETROLEUM REFINERY ENGINEER, A.M. ASCE. Eleven years of experience in engineering, maintenance and construction of petroleum refineries, pipelines and terminals. Desire position with oil company on construction of petroleum facilities. C-500.

CIVIL ENGINEER, CONSTRUCTION AND/OR DESIGN, A.M. ASCE, B.S.C.E. cum laude, Tau Beta Pi, Veteran, age 24. Two years with the U.S. Navy Civil Engineer Corps; one year as administrative officer of construction battalion; and one year as assistant resident officer in charge of construction. Desires opportunity to obtain experience. Will consider any location. C-501.

OFFICE ENGINEER, A.M. ASCE, B.S. in C.E., age 35. On highway construction for two years, and dam construction for four years. Location desired, New York State, Great Lakes area. C-502.

WATER RESOURCES HYDRAULIC ENGINEER, M. ASCE, AWWA, AGU, PE—New York, age 33. Nine years' USBR river basin planning, doing estimates and reports for hydro, irrigation and water supply developments, domestic and foreign, heavy on dam and conveyance design; two and a half years with major consulting firm for thermal, hydro and nuclear installations, water yield, and operating and economic studies for hydro development. Location desired, New York area. C-503.

STRUCTURAL ENGINEER, A.M. ASCE, B.C.S., M.S.C.E., age 29. One year on construction supervision, four years as university instructor, and five years on structural design of bridges, buildings, special structures, reinforced concrete, steel, timber. Location desired, Midwest, West. C-1003-Chicago.

CHIEF ENGINEER, A.M. ASCE, B.S.C.E., age 32, P.E.—four states. Ten years' experience in consulting and construction. Past four and a half years have been with A & E as chief structural and civil engineer, project coordinator and

negotiator. Experience includes supervision of personnel, testing programs, structural design of commercial and industrial structures, water works, and sewage projects. Desires position with industrial building expansion program or consulting. Location desired, South or Midwest. C-1007-Chicago.

PROFESSOR OR RESPONSIBLE EXECUTIVE POSITION, F. ASCE, B.S.C.E., E.E., M.S.C.E., age 54. Retiring Engineer Colonel, licensed in Nebraska. Fifteen years' industrial engineering with public utility; eighteen years' military experience including policy making general staff positions, supervisor large construction programs; and two and a half years' college level teaching. Available July, 1960. C-1009-Chicago.

STRUCTURAL OR PROJECT ENGINEER, M. ASCE, B.S.C.E., age 32. Ten years of structural and civil engineering experience including design of timber, steel, concrete and aluminum structures and buildings. Follow projects to completion in field, supervise draftsmen, registered structural and P.E. in Illinois. Location desired, South, West or Midwest. C-1011-Chicago.

CONSULTING ENGINEER, M. ASCE, B.S.C.E., age 22. Field engineer and draftsman in water and sewage treatment systems, subdivision layout and design, highways and streets, and property surveys for one and a half years. Location desired, Minnesota or Wisconsin. C-1006-Chicago.

STRUCTURAL DESIGNER, A.M. ASCE, E.S.C.E., professional license California and Kansas, age 33. Four years of experience supervising engineers and draftsmen in design of industrial and power plants, specifications, schedules; six months doing records, schedules, estimates for manufacturer; one year as chief engineer on subdivision for home builders, and two years on maintenance and new construction for major Naval installations. $8,400 per year. Location desired, San Francisco Bay Area or Western U.S. S(M)-1651.

FIELD OR CITY ENGINEER, M. ASCE, B.S.C.E., Oregon Professional Civil Engineer License, age 36. Two and one-half years experience in the field designing, surveying, inspecting, and installing equipment of salt production facilties, harbor facilities, blast furnace and steel mill, five years as plant engineer in charge of engineering and maintenance for pharmaceutical company, and two and one-half years as junior civil engineer on public utilities. $8,400 a year. Location desired, California or Southwest. S(M)-1271.

DESIGN OR FIELD ENGINEER, A.M. ASCE, B.S.C.E., Professional Civil Engineer License, age 29. Nine years of experience as designer of highways and bridges, math instructor for Army on budget estimates, specifications, and as construction supervisor for building and road construction supervisor for building and road construction for a petroleum company. $9,600 a year. Location desired, South America or Overseas. S(M)-1235.

ESTIMATOR OR INSPECTOR, M. ASCE, B.S.C.E., age 33. Ten and one-half years experience as chief estimator, project supervisor, and maintenance and equipment inspector on construction of petroleum refining and chemical plants, airbases and facilities, pipeline, tank farm and pumping station facilities. $9,600 a year. Location desired, Foreign, South or West. S(M)-1220.

HYDRAULIC OR SANITARY DESIGNER, A.M. ASCE, B.S.C.E., M.S. hydr. Professional License in California, New York and Connecticut, age 35. Six and one-half years on the design and development of sewer systems, treatment plants, water supply and distribution facilities, hydrologic studies, flood control, permits for construction of bridges and dams for water conversion as director of public works. $10,000 per yr. Location desired, San Diego or San Francisco. S(M)-989.

ASSISTANT CIVIL ENGINEER, A.M. ASCE, B.S.C.E., age 27. Two years of experience on design, specification writing, reports on highway, hydraulic structures, draft for subdivision for public works. Two years survey for Army (completed). $6,600 a year. Location desired, San Francisco. S(M)-921.

SOILS ENGINEER, M. ASCE, B.S.C.E., age 25. Seven years' experience with soils; four with consultant and government in exploration, test, evaluation, analysis, reports and, three years' with test lab and government performing tests. All work in close connection to construction. Also two years on construction estimating and two years with water utility. $8,400 a year. Location desired, California. S(M)-581.

PROJECT ENGINEER AND DESIGNER, M. ASCE, B.S.C.E., California Professional Engineer License, age 40. Thirteen years of experience on design, construction, management, contract negotiations, coordination on public works, military airbases and flood control for engineers-constructors and government. $11,400 a year. S(M)-577.

PROJECT MANAGER OR SUPERINTENDENT, A.M. ASCE, B.S.C.E., age 52. Twenty-eight years experience on heavy construction and building, estimating jobs, setting up, ordering and scheduling material, labor and equipment, handling labor negotiations and contracting agencies. Broad experience in procession materials for concrete, highways, dams, airbases, missile sites, waterfront construction and industrial buildings. Salary open. S(M)-502.

FIELD ENGINEER, A.M. ASCE, B.S.C.E., age 28. Two years of experience on design, reports, inspection, draft, quantity take-off, estimates, survey on freeway construction, flood control and water conservation for public works. $7,200 a year. Location desired, San Francisco Bay Area, Southern California or Florida. S(M)-467.

STRUCTURAL DESIGNER, A.M. ASCE, B.S.C.E. Licensed Professional civil and structural engineer in Illinois. Three years on structural design of steel, timber and aluminum structures for manufacturer and fabricator, three years on design of manufacturing containers; three years as engineer draftsman on heavy steel industrial buildings and small structures for consultants and railroad company. $10,000 a year. Location desired, South or West. S(M)-1068.

DESIGNER OR FIELD ENGINEER, A.M. ASCE, B.S.C.E., age 39. Three years on design and detail of reinforced steel for concrete arches, girders, slab bridges, highway location and design for government. Five years as chief of party, and structural detailer on bridge surveys. $6,000 a year. Location desired, West or foreign. S(M)-287.

DESIGNER, A.M. ASCE, Professional Civil Engineer License in California, age 31. Three years of experience in charge of design of steel, reinforced concrete and wood structures for consultant; two years on design of offshore oil platform, research on structures for petroleum company; and three months on field inspection of bridge construction. $10,200 a year. Location desired, San Francisco Bay Area. S(M)-242.

PROJECT ENGINEER AND ESTIMATOR, A.M. ASCE, B.S.C.E. Registered in Louisiana, age 30. Ten years of diversified experience. Qualified in Federal Civil Service as GS-13. Now employed as civil project engineer in large petro-chemical plant, can supervise men. Solid design and estimating background. $9,000 a year. S(M)-1911.

News of Members

(Continued from page 124)

Richard C. Gerke announces formation of the Pasadena, Calif., firm of Richard C. Gerke and Associates, manufacturers representatives for engineered or construction products and will also represent out-of-town firms for engineering or construction services. He was formerly special products manager for Vinnell Steel.

A. Bert Caseman, after a two-year leave of absence, has returned to his post as associate professor of civil engineering at the Georgia Institute of Technology. The sabbatical allowed Professor Caseman to attend the Massachusetts Institute of Technology on a National Science Foundation "Science Faculty Fellowship." His thesis work was in the field of shell-buckling.

Murray B. McPherson has been appointed professor of hydraulic engineering at the University of Illinois. On the Lehigh University faculty for ten years, he has been research engineer and chief of the Research and Development Unit of the Philadelphia Water Department for the past two years. Professor McPherson is currently serving on task committees of the ASCE Hydraulics and Sanitary Engineering Divisions.

Richard E. Reiss and **Richard L. Brown** recently formed a partnership for the practice of civil and structural engineering under the firm name of Reiss and Brown at 1150 South Beverly Drive, Los Angeles 35, Calif. Both men were formerly project engineers with Albert C. Martin & Associates, architects and engineers of Los Angeles.

J. W. Hubler, vice president of engineering of Macomber, Inc., at Canton, Ohio, was recently elected to membership on the board of directors. Mr. Hubler joined the Macomber organization in June 1955 after completing over thirteen years of teaching at Washington University, where he served as professor and head of the department of civil engineering.

George Torrey Ingalls is now chief structural engineer with the Ebasco International Corporation, of New York City. Prior to his promotion, he served the firm as structural design engineer.

Information received before March 15, 1960, will appear in the 1960 Directory

FOR ASCE MEMBERSHIP DIRECTORY

Name ......
Last Name (Please Print) First Name Middle Name

Title or Position ......
Please Print or Type All Information

Name of Firm or Organization ......

Business Address ......
Street
......
City Zone State

Residence Address ......
Street
......
City Zone State

Send Mail and Publications to: ☐ **Business Address** ☐ **Residence Address**

Nature of Firm's Business ......
Product, Business or Service (Not for Publication)

Signature ...... **Date** ......

DO NOT WRITE IN THIS SPACE

ABC

OLD L.S.

NEW L.S.

T&B CHANGE ONLY

Gerald B. Keesee, after serving for almost a decade as water rights specialist with the Bureau of Indian Affairs in Gallup, N. Mex., has been appointed to the Commissioner's staff in Washington, D.C. as general engineer. One of the nation's foremost proponents of Indian water rights, Mr. Keesee has been with the Bureau for over two decades.

Ronald L. Stevens has been appointed an associate engineer in the plant engineering department at the Bernen Estate of the International Business Machines Corporation, Yorktown, N. Y. Mr. Stevens joined IBM in 1957 as a building engineer after graduating from Union College.

Oliver G. Coulling, until recently principal engineer for H. W. Taylor, of Freeport, N. Y., has been named engineer for the newly formed Augusta (Me.) Sewer District. Since graduating from the Brooklyn Polytechnic Institute in 1950, he has worked on sewer design for several sewer districts.

Maurice Greenberg was recently appointed to the position of engineer of tests and research for the Detroit City Engineer's office. Before joining the city engineering department in 1949, Mr. Greenberg was associated with the State Highway and Engineering Research Institute of the University of Michigan, and was for a time in private practice in municipal engineering.

L. J. Markwardt has retired as assistant director of the U.S. Forest Products Laboratory at Madison, Wis., to become a consultant for several industrial concerns in the forest products fields. He joined the Laboratory just two years after it was founded by the U. S. Forest Service, and since then has had the equivalent of three careers, consisting in equal parts of research, administration, and educating people about wood as an engineering material.

Jimmy W. Seyler, since 1954 assistant professor of civil engineering at the University of Illinois, has been appointed assistant secretary of the American Society for Engineering Education. Professor Seyler will continue teaching at the university while serving as half-time assistant secretary.

Arthur C. Beard has joined the Portland Cement Association as field representative for Long Beach and Orange County following eight years service as a naval construction officer with the rank of lieutenant. Immediately before leaving the service he was assistant officer in charge of construction contracts at the El Toro Marine Air Base. His home is at Costa Mesa, Calif.

Mayor R. Dewey Stearns says...

"Saginaw's modern water system pays for itself 365 days a year!"

"Good, fresh water—with its quality protected by miles of Transite Pipe—helps make Saginaw, Michigan, a wonderful place to live . . . work . . . and do business!"

"Busy shoppers in downtown Saginaw give an accurate indication of the active business climate our citizens enjoy . . ."

"Diversification is important to our economy. And each industry —from automotive products and heavy machinery to baking equipment, precision instruments and agriculture—*thrives on water* . . ."

"Because good water is vital to the life and growth of Saginaw, we go to one of the best raw water sources in the Midwest . . . to Lake Huron for a limitless supply of the finest and purest water."

"A water system must undergo continuous expansion to meet growing domestic, industrial and fire protection needs. Transite Pipe has helped Saginaw expand economically and efficiently since we first used it in 1933."

J-M Transite Pipe safeguards water purity... helps keep its cost low!

Made of tough, durable asbestos-cement, Transite® Pipe cannot rust . . . stays clean to protect the quality and purity of the water it carries!

Transite also saves tax dollars for other uses—it is installed quickly, economically . . . its smooth interior keeps pumping costs low . . . its Ring-Tite® Coupling conserves precious water. And, of course, Transite Pipe is noted for its unusually long life.

For information on how Transite Water Pipe (and Transite Sewer Pipe, too) can serve your city write Johns-Manville, Dept. N-9, Box 14, New York 16, N.Y.

Your prosperity, welfare, safety, depend on good water . . . and plenty of it. Now is the time to support your water program . . . and water utility officials.

JOHNS-MANVILLE

JOHNS-MANVILLE JM PRODUCTS

Great Lakes cities are competing with each other to build facilities to attract and service St. Lawrence Seaway traffic. The City of Cleveland was one of the first to start, and built the new West 3rd Street Pier and West 6th Street Pier to meet Seaway specification depths of 27 feet alongside. The West 3rd Street Pier is 710 feet long and 509 feet wide and has an area of 4.1 acres. The West 6th Street Pier is 697 feet long, 297 feet wide and has an area of 4.65 acres. Both piers are constructed of USS Steel Sheet Piling which is utilized to enclose the developed area. These piers may well be the forerunners of many similar structures being considered for Great Lakes ports.

The West 6th Street Pier is the newest of the two, having been only recently completed. For this job the engineers considered various types of structures but finally selected an anchored steel sheet pile bulkhead to enclose the area to be developed. Comparative bids proved this to be the most economical type of pier. What's more, it could be built quickly.

For maximum beam strength, Z-type steel sheet piling was chosen. The general contractor, Merritt-Chapman & Scott Corporation, Cleveland, Ohio, wanted quick deliveries and service . . . so they ordered USS Steel Sheet Piling. They used 2,252 tons of Z piles in 60-foot and 70-foot lengths. The steel sheet piling was driven to 33 feet of penetration beyond the 27-foot dredged depth. Side walls of the pier are retained with double channel wales and 3-inch diameter tie rod assemblies extending across the full width of the pier. The front wall is anchored with wales and the tie rods to batter pile assemblies incorporating concrete filled pipe piles. A novel fender system protects the pier in which cored rubber inserts furnish required resilience.

Theoretical assumptions relative to horizontal pressures on earth retaining structures are still undergoing investigation by scientists. In order to assist in the development of more accurate knowledge of this subject, permanent strain gauges were installed at critical points in the piling.

The design of these structures was under the direction of W. J. Rogers, Director of Port Control, and J. H. Rowland, Commissioner of Harbors, City of Cleveland. The Osborn Engineering Co. of Cleveland were Consulting Engineers.

When you need any type of steel piling, steel sheet piling, H-piles, or pipe piles, call the nearest United States Steel office, or contact United States Steel, 525 William Penn Place, Pittsburgh 30, Pennsylvania.

USS is a registered trademark

Air view of the 202,257-square-foot West 6th Street Pier and to the left the 177,800-square-foot West 3rd Street Pier. Both piers constructed by Merritt-Chapman & Scott.

USS Z Piling offers strength and economy in building piers and bulkheads.

United States Steel Corporation—Pittsburgh
Columbia-Geneva Steel—San Francisco
Tennessee Coal & Iron—Fairfield, Alabama
United States Steel Export Company

United States Steel

EQUIPMENT, MATERIALS and METHODS

NEW DEVELOPMENTS OF INTEREST AS REPORTED BY MANUFACTURERS

Power-Curve Loaders

A NEW CONVEYING SURFACE having at least three times the service life of previous materials is announced by the company for its new 1960 model car loaders and bag conveyors. The conveyors use spring steel belts to permit a continuous bag conveying surface which can be swung to right or left for high speed loading of box cars and trucks and for all other bag conveying service. A change in steel analysis and spring manufacturing technique is now used.

The new car loader is vastly improved in many respects. The entire unit is stronger and simpler, capable of taking greater abuse. With a Power-Curve Loader installation, one man can load without aid at least two box cars an hour. **The Power-Curve Conveyor Co., CE-12, 2185 South Jason, Denver 23, Colo.**

Alloy Precision Shear Plate

A NEW ALLOY PRECISION shear plate for timber and structural fastening has been designed. The shear plate is pressure cast of aluminum alloy to tolerances which cannot be held in cast iron plates. In addition, the exclusive patented compression rings cast into the plates raise the shear value of the plates beyond that of cast iron. Shear values are equal to the bolt used in fastening.

In the new shear plates nails are cast as an integral part of the plate, thereby eliminating the use of common nails for fastening, and greatly increasing the speed and efficiency of the fastening operation. The plates are rust-proof, and require no galvanizing or painting—rust streaks on adjacent woodwork are eliminated. The use of aluminum alloy shear plates will greatly reduce the initial and installations costs of structural work. **Timber Hardware Co., CE-12, 3400 NE 54th Ave., Portland Oregon**

Long Distance Warning Light

THIS NEW WARNING LIGHT has a lens the diameter of a traffic signal, 8 in., and delivers 60 candle power for 650 hours. To be used as an abutment safety light on toll roads and all limited access highways, the new No. 680 flasher is equipped with a single face parabolic reflector lens, two Neda No. 6 dry cells, transistorized circuit, carrying handle and mounting bracket. Flash rate is 65 per minute. Tamperproof mounting and on-off bolts require special Allen-type wrenches. Finished in beacon yellow, fixture is available with either amber or red lenses. **R. E. Dietz Co., CE-12, Syracuse, New York**

Improved "Jungle Buster"

A NEW MACHINE HAS been developed for knocking down and chewing up several acres of unproductive forests per hour.

An experimental test model has already been pitted against unproductive scrub forests in North Carolina and Mississippi, successfully reclaiming the land for useful purposes. For example, in North Carolina working under rough conditions such as 30% slopes, the 95,000-lb "Tree Crusher" averaged an acre of land every 21 minutes. On level cutover areas with heavy hardwood stands, the average was an acre every 17 minutes.

Projected production costs rate the machine at $3.50 per acre cleared, which compares with costs of $9 to $12 per acre for the same job done with bulldozers and dynamite.

The new G-40 is less than ⅓ as heavy or bulky as previous models of Tree Crushers which the company developed for ultra-dense jungle areas in Africa and South America. The prime need in the United States is for a machine large enough to clear the land, but small enough to be easily transported from one job location to the next. The present model has been designed so compactly that it can be shipped completely assembled except for a "push beam bumper" which is easily and quickly removed. **R. G. LeTourneau, Inc., CE-12, 2399 South MacArthur, Longview, Texas**

Hourly Weather Reports for Construction

WEATHER INFORMATION OF special value to those on engineered construction is available to projects that have radios which receive on the 200-400 kc band. The service is provided by the Federal Aviation Agency throughout the U.S. and its territories. The information is primarily for fliers but the detailed prediction is helpful in determining action on outdoor construction.

At 15 minutes after each hour, these LF range stations report weather conditions observed shortly before the hour at their stations as well as at nearby airfields, supplying a complete weather picture for 100 miles around the station. The data transmitted includes: cloud conditions, ceiling, visibility, wind direction and velocity, temperature, dew point and barometric pressure.

A summary broadcast at 45 minutes after each hour gives weather conditions at the station itself and at major airports up to several hundred miles away. Flash advisories are given if there are dangerous weather conditions within 200 miles of the reporting station.

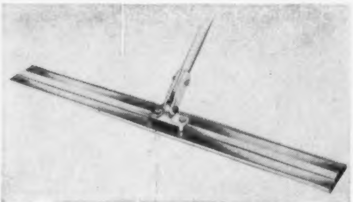
Two Zenith all-transistor portable radios which receive the weather broadcasts, Royal "760" The Navigator is a super-sensitive receiver for both standard broadcast stations and weather service on government LF aviation bands and has a self-powered emergency navigational aid for planes and boats. The Model 1000 D operates at low cost on ordinary flashlight batteries. It includes a new Low Frequency band, Marine and Weather and International Shortwave. **Zenith Radio Corp., CE-12, 6001 W. Dickens, Chicago 39, Ill.**

EQUIPMENT MATERIALS and METHODS

(continued)

Extruded Aluminum Float

DEVELOPED FOR CEMENT FINISHERS, this new extruded aluminum float is stronger than a cast float. A 6-ft magnesium handle that is flexible enough to "jitterbug" or bring "fat" to the surface of the slab, but stiff enough to give long-wearing, efficient float action, is designed to prevent hand-cramping during all-day-long use.



Stronger Than Cast Float

The float bottom has a slightly "bowed", broken-in shape for immediate use in the field. The top of the float has a rigid "backbone" for added strength and rigidity. The new model, complete with handle, comes in two sizes, 42 in. x 8 in. and 48 in. x 8 in. **Goldblatt Tool Co., CE-12, 1910 Walnut St., Kansas City 41, Mo.**

Light Gauge Sheet Steel Roof

A ROOF MADE OF light gauge sheet steel that can span wide distances without support has been invented by a Nebraska manufacturer of metal buildings. It is said to be at least 25% lighter than conventional truss roofs.

Named the Dubl-Panl roof, the new construction method utilizes 13- to 20-gauge aluminized or galvanized sheet steel to carry loads. The company says full-scale tests show the roof's clear-span economy features show best in a flat roof span of 50 to 300 feet, an arched roof from 200 to possibly 1,000 ft and a cantilever overhang of up to 200 ft.

The same Dubl-Panl units can be used for walls. Such walls would be designed to resist various wind loads in any desired heights, again at lightweight economy. The new roof has two basic components, both light-gauge steel: the channel-grooved panels and hat-shaped struts.

The panels, bolted together, form upper and lower stressed chords of the roof and also serve as roof and ceiling. Between the panel-chords are rows of diagonal struts or webbing of the hat-shaped struts. The rows are 41 inches apart (same

(Continued on page 130)

width as the panels), and are bolted to tabs on the panel. The strut system transfers perpendicular loads into axial stresses in the panel-chords. The lateral load is transferred to walls, which eliminates need for lateral bracing. **Behlen Manufacturing Co., Inc., CE-12, Columbus, Nebraska.**

Miniature Drafting Set

THE NEW, LIGHT-WEIGHT, Brief Case Style Design Pak has been introduced. This set eliminates the need for supplementary drawing instruments. Built-in engineering features include a precision, portable drafting machine, Holemeter, protractor as well as vertical and horizontal scales. A supply of "A" size drawing paper and drawing pencil are also included.

The brief case holder permits drawing in the flat position or by rotating the cover 360 deg and snapping the case together, and provides an 8 deg inclined drawing surface. This miniature drafting set furnishes engineers, designers or architects with capabilities to execute rapid, accurate engineering sketches while on the job, en-route or at home. The drawing surface is "dead white" to provide maximum contrast to drawing lines and has a built-in recovery if heavy pencil impressions are made. **The Charles W. Thrift Co., CE-12, 3312 W. Vernon Ave., Los Angeles, Calif.**

Tandem Drive Trencher

A COMPLETELY MOBILE TRENCHER mounted on rubber tired wheels with road speeds up to 30 miles per hour has been announced. The trencher features such innovations as a point-of-balance shifter which allows a 24-in. shift forward or back. This is comparable to shifting 1,500 lb in either direction, and allows the machine to perform such feats as crossing trenches without back filling.

Completely Mobile

The digging wheel is operated hydraulically, all controls are within inches of the steering wheel, and the machine has three conveyor belt speeds for placement of spoil banks and four digging wheel speeds.

The company states that the trencher uses engines, transmissions and universal joints of national standard makes, and emphasizes that most parts are readily available through nation-wide automotive distributors. **Speicher Bros., Inc., CE-12, Portland St., Celina, Ohio**

LANDMARKS OF MUNICIPAL PROGRESS...

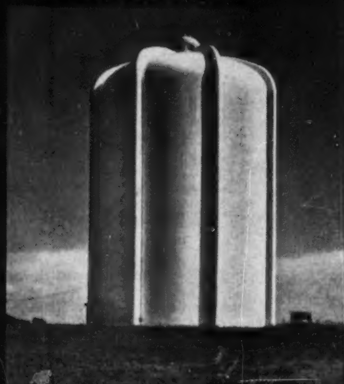
Modern Water Storage Tanks built by

CB&I

RADIAL-CONE
Standard sizes: 500,000 to 3,000,000 gals.

WATERSPHERE
Standard sizes: 25,000 to 250,000 gals.

ELLIPSOIDAL
Standard sizes: 15,000 to 500,000 gals.



ORNAMENTAL STANDPIPE
No limit to capacity

SPHEROIDAL—Standard sizes: 200,000 to 3,000,000 gals.

WATERSPHEROID
Standard sizes: 250,000 to 500,000 gals.

CHICAGO BRIDGE & IRON COMPANY

CB&I

332 SOUTH MICHIGAN AVENUE
CHICAGO 4, ILLINOIS

OFFICES AND SUBSIDIARIES IN PRINCIPAL CITIES THROUGHOUT THE WORLD

M62CB

EQUIPMENT, MATERIALS and METHODS

(continued)

Concrete Paver

ABLE TO MIX AND pour about a half mile of highway a day (24 ft wide, 9 in. deep), the new Tribatch concrete paver produces better than 40% more concrete than the largest pavers now in use, pouring about 250 lineal feet of standard 2-lane highway every hour, according to the manufacturer.

The Tribatch uses a 3-compartment drum for mixing aggregate, cement and water to form concrete. Present big capacity pavers use a 2-compartment mixing drum. The net result is a decrease in cycle time from 42 sec to 29 sec, based on a mixing time of 60 seconds. That means approximately two batches of concrete are produced every minute.

Despite the increase in capacity and operating functions, the new machine is actually easier and simpler to operate than dual drum pavers now in the field. This is due to the Batchmeter, an electric automatic control of all the mixing cycle functions including raising of the skip, introduction of the water and operation of the transfer chutes and discharge chute. Safety devices prevent one function from taking over until all preceding functions have been fully carried out. **Koehring Div., Koehring Co., CE-12, 3026 W. Concordia Ave., Milwaukee 16, Wisconsin**

No-Joint Machine

A MACHINE THAT CASTS concrete pipe directly in the trench at substantial saving in cost, has recently been developed. Essentially a round-bottomed "boat", the No-Joint machine is lowered into the trench which is dug to conform to the outside diameter of pipe size. Ready-mixed concrete is poured into a hopper as the machine moves forward in the trench extruding the formed pipe in its "wake". A gasoline motor mounted at the front of the machine provides the power for winching forward and for vibration and compaction of the concrete as it is pressed through to form the pipe.

During construction the upper half of the pipe is supported by sectional aluminum forms which are placed as the machine moves along, and the trench itself forms the lower half. The aluminum sections are removed and made ready for re-use after initial set of the concrete.

Demonstration tests were made on a three-day-old section of pipe with a 23-ton bull dozer running back and forth over the filled trench. In succeeding "runs" more of the protecting layer of dirt was removed and the pipe was subjected to the sharp blows of the dozer blade. With only a 3-in. layer of dirt remaining, the pipe was still intact. **Monolithic Pipe Lines, Inc., CE-12, P.O. Box 356, Station A, Palo Alto, Calif.**

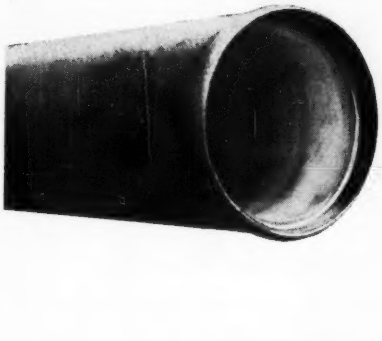
Fab-Form Sheets

DESIGNED FOR SLABS POURED OVER beams or joists, Fab-Form sheets possess physical properties not available in other short-span permanent steel form materials and are available in lengths up to 28 ft 3 in., twice as long as competitive sheets now on the market, the manufacturer states. Fab-Form saves materials and erection time because less material is used and fewer laps are encountered.

Fabricated from 27-gage cold rolled, high-tensile strength steel, Fab-Form has deeper corrugations (full ⅝ in.) than

(Continued on page 134)

EXTRA SAFETY FACTOR!



CONSERVATIVE DESIGN is one of the important reasons why American Concrete Cylinder Pipe has gained such high acceptance by engineers and water works officials in the west. The composite design of the pipe is based on a factor of safety of 2¼ at the elastic limit of the pipe. American Concrete Cylinder Pipe will safely withstand sudden and severe increases of pressure – surge and water hammer – or the occasional concentrated external loadings met under unusual field conditions.

The *composite* action of the mortar lined steel cylinder, circumferential rod reinforcement and external mortar coating accounts for the consistently successful performance record of this type of pipe. The use of a minimum of 25% to, under certain conditions, 50% or more of the total required cross-sectional steel area as tension-wound circumferential reinforcement substantially increases the pipe's external supporting strength over that which would be obtained if all of the required steel area were placed in the cylinder alone.

Take advantage of American Concrete Cylinder Pipe's greater inherent strength through more effective use of materials – see an American sales engineer when planning your next project.

CONCRETE PIPE FOR MAIN WATER SUPPLY AND TRANSMISSION LINES

American PIPE AND CONSTRUCTION CO.

LOS ANGELES: 4635 Firestone Blvd., South Gate, Calif.— LOrain 4-2511 • **HAYWARD:** P.O. Box 630 — JEfferson 7-2072 • **SAN DIEGO:** P.O. Box 13 — CYpress 6-6166 • **PORTLAND:** 518 N.E. Columbia Blvd. — BUtler 5-2531 • **ALBUQUERQUE:** P.O. Box 1782 — CHapel 7-0486 • **PHOENIX:** American Concrete Pipe Co. (Subsidiary) P.O. Box 12127 — Alpine 2-7566

EQUIPMENT MATERIALS and METHODS

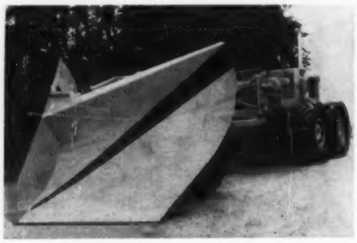
(continued)

other standard form materials. It is available uncoated or coated with a baked on iron-oxide primer. Coated Fab-Form first is cleaned chemically, then Bonderized and finally painted with a special re-oxide primer which is baked on at temperatures up to 650 deg F. It may be stored uncovered on the job with no unfavorable results from weathering. **Pittsburgh Steel Products Div., Pittsburgh Steel Co., CE-12, Grant Bldg., Pittsburgh 30, Pa.**

Motor Grader Snow Plow

THE MOLDBOARDS OF THE new Model BV14 Snow Plow are curved with a conical shape to lift the snow and throw it to the side with a minimum amount of effort.

Available through Caterpillar dealers for the Cat No. 14 Motor Grader, the plow attaches to the grader in the conventional manner with self-aligning push



Model BV14

arms quickly connecting it to the king pin in front of the grader. The BV14 may be controlled either by Cat scarifier controls or by Cat hydraulic controls.

Specifications include front height 4 ft 3 in., rear height 7 ft 8 in., cutting width 10 ft 6 in., extreme width 12 ft, weight 2730 lb with double acting scarifier control, 2880 lb with double acting hydraulic control. **Balderson Inc., C-12, Wamego, Kansas**

Magnet Chain Assemblies

FABRICATED FROM TOUGH, DURABLE alloy steel components and heat-treated for maximum service life, these Accoloy #125 Steady-lift Magnet Chain assemblies have been designed so as to accommodate electrically-energized magnets of all sizes and lifting capacities.

Pinched fingers are completely eliminated by the erect Master Link. Because

(Continued on page 136)

of its rigid section, the crane operator can pick up or deposit the assembly at any location in the plant or yard without having any crane follower or other employee handle it.

Tripod construction prevents chain damage due to twisting, a common cause of excessive wear and breakage with conventional magnet chains. All legs are replaceable in the field, being connected to the master alloy casting with square-end pins, which prevent rotation, thereby eliminating wear of casting at attachment points. **American Chain & Cable Co., Inc., CE-12, 929 Connecticut Ave., Bridgeport 2, Conn.**

Reroofs Navy Hangar

WHEN A CONCRETE HANGAR at the Oceana, Va., Naval Air Station was recently reroofed with built-up smooth surface asbestos over felt insulation, the contractor cut time and material costs by using an improved method of anchoring furring strips to the weathered concrete roof.

Asbestos roofing was fastened to 1 x 6 pine furring strips between which the felt insulation was laid. The furring was anchored solidly to the old concrete roof by drilling holes right through the strips into the concrete, then hammering home Rawl-Drive one piece expansion bolts. Anchoring the furring, laying insulation and roofing the area of 80,000 sq ft was completed in four months. To meet the requirements of 3,000 lb minimum holding power for the anchor fastening the furring to the concrete, the 5/16 x 2½ expansion bolts on the job site were tested with a portable dynamometer and found to withstand pulls greater than 3,500 lb. **The Rawlplug Co., Inc., CE-12, 242 Petersville Road, New Rochelle, N. Y.**

Quick Splice for Concrete Pile

A NEW MATERIAL HAS proved successful in splicing concrete piles. Following is the procedure developed by C. W. Blakeslee Co. of New Haven, Conn., to quick splice concrete piles with Florok's Plasticement: base is drilled, or dowel holes are precast to receive reinforcing dowels previously cast into top section; the units are then lined up properly and a steel jig or boot is placed around the joint and securely locked in place; Florok's Plasticement is melted and ladled into spouts of jig or boot; allowed to set for a minimum of 15 minutes, the jig is then removed and work resumed.

The Blakeslee Co. conducted tests on prestressed piles driven to refusal and then spliced with the new material. After 300 blows with a No. 1 Vulcan hammer, there were no cracks or breakdown. With a lateral pull of 470-in. kips from 10 ft above the splice the pile broke below the splice. **The Chargar Corp., CE-12, 1013 Dixwell Ave., Hamden, Conn.**

Channel Screw Feed Mountings

NEW CHANNEL SCREW FEED mountings for jumbo drilling operations in tunnels have been introduced.

The 2MC series screw feeds mount 4½- and 5½-in. percussion drills for tunnel jumbo drilling operations and are operated by remote control; controls for both the drill and the feed motor may be mounted in any location for maximum accessibility. Automatic wet controls are standard on 2MC mountings, but it is simple to convert them for dry drilling.

Operated By Remote Control

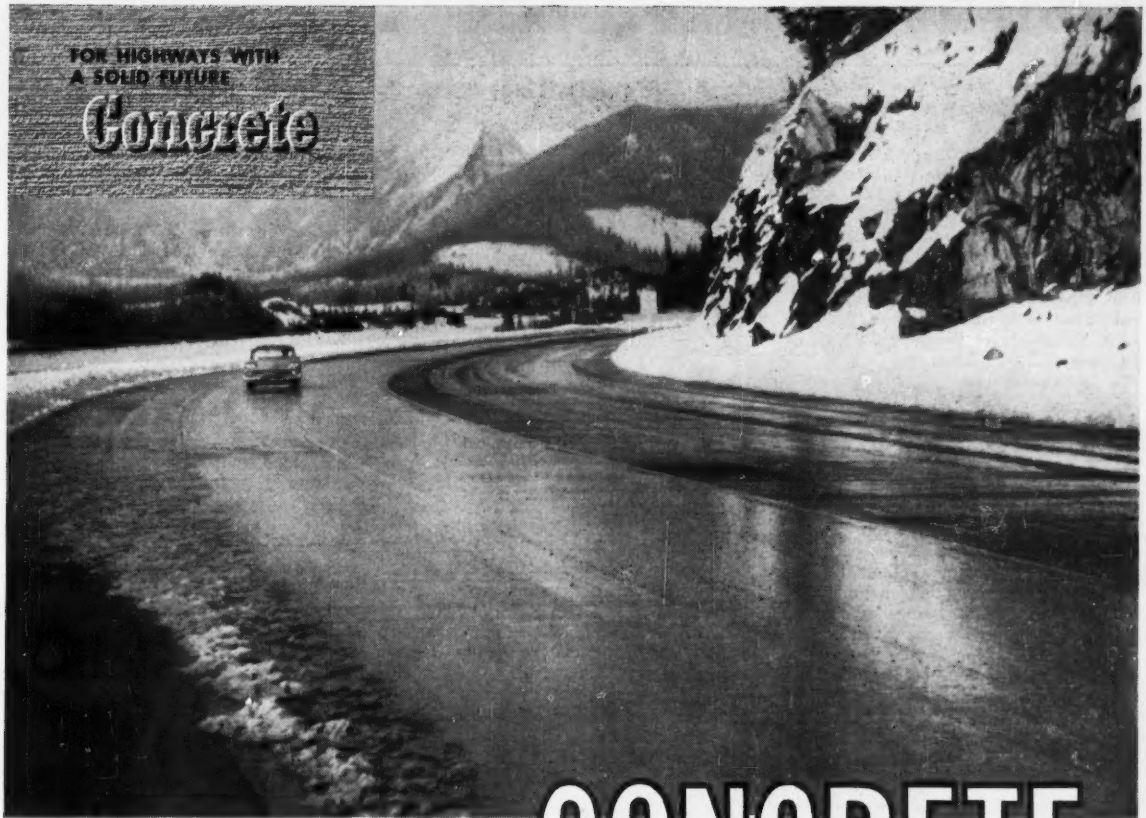
The drill, feed motor and the feed screw bearing are lubricated by a LO15A line oiler. The feed screw is constantly lubricated by drill exhaust. Centralizer pivots and the front feed screw bearing are lubricated by grease.

The feed screw is made of tubular steel with spline drive. Feed screw bearings sleeves and thrust washers are renewable and the 2MC series is equipped with a long-wearing feed screw nut. **Gardner-Denver Co., CE-12, 100 Williamson St., Quincy, Ill.**

Fireproof Square Columns

FIREPROOF COLUMNS IN BOTH standard square column and Karri-More square column, which feature additional reinforcement within the column, have been made available.

(Continued on page 138)



For Snoqualmie Pass, it's CONCRETE...

the only pavement with built-in protection against weather damage

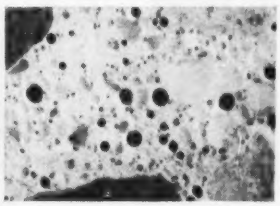
High in the Cascade Mountains of Washington, new Interstate 90 year in and year out must face the toughest punishment weather can give.

Snows are mighty heavy in Snoqualmie Pass. 30 feet a year is nothing unusual. For 5 months every year, it takes the biggest and heaviest snow removal equipment in the business to keep the road passable.

Traffic is plentiful and, when the road is posted, every car uses chains designed to take a deep bite. This is really tough on the road surface—but concrete is meeting every test.

As a special safeguard, bubbles by the billions (air entrainment) have been put into this concrete. And through temperature changes and repeated freezing and thawing, the surface is kept free of any scaling or break-up. Even tons of de-icers can't cause harm.

Here's a perfect example of the *stability* found in concrete under the most difficult and extreme conditions. One more reason why you're seeing so many new concrete highways. They are stretching out mile after mile on Interstate and other heavy-duty routes everywhere.



Checking bubbles by the billions, the "air void analyzer" gives an electronic control on air entrainment. Some 5 million bubbles per cubic inch of concrete (magnified specimen at right) give freezing moisture the room to expand.

PORTLAND CEMENT ASSOCIATION

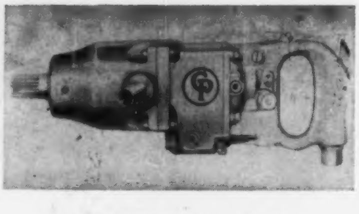
A national organization to improve and extend the uses of concrete

The fireproofing material used is a special lightweight concrete that effectively insulates the columns from excessive heat. This fireproofing material is placed between the main column shell and a thin exterior steel shell, for neat, trim appearance. Thickness of the material is one inch on all sides of the column. **Shlagro Steel Products Corp., CE-12, Somerville 43, Mass.**

Air-Powered Impact Wrench

A NEW TORQUE CONTROL reversible Impact Wrench, capable of consistently accurate and fully controlled torque output as high as 1,000 ft lb, has been introduced. This accuracy eliminates all need of time-consuming hand-torque follow-up or sampling for uniformity. The tool's torque-control mechanism is totally enclosed, keeping tool length to a minimum and eliminating the need for extensions and adapters.

Designated the CP-612-RLTP, the tool weighs only slightly more than its predecessor yet packs 25% more power



Dual-Purpose Performer

in its streamlined 19-in. compact frame. Its reliable aluminum-encased "Power Vane" rotary motor is stopped the instant the preset torque value is reached, guaranteeing precision workmanship.

In addition, it features the ultra-efficient spline drive shank with the built-in Socket-Lok. Engineering tests have proved the spline drive shank and socket substantially minimize the power dissipation that frequently results from square shanks. Shank breakage and socket losses, frequent causes of downtime, are also sharply reduced. **Chicago Pneumatic Tool Co., CE-12, 6 East 44th St., New York 17, N. Y.**

Precision Batterboard

A PRECISION INSTRUMENT to replace the old hit-or-miss cornering system in staking out foundation lines is being introduced. The "Minute Man Batterboard" is constructed of aluminum and steel and comes equipped with sliding built-on levels and retractable rules for each arm. The ball-and-socket corner joint allows leveling of each horizontal arm independently without distortion to the other.

According to the manufacturer, two men with the batterboard can lay out a building in a fraction of the time required to do the entire job. Stakes have solid steel points and driving plugs and are cadmium plated to resist rust. The sharp point of the one inch diameter driving stakes make them easily inserted and removed from the ground.

A feature of the sliding unit on each arm is the quick-hold string holder which automatically places the taut string at the predetermined level of the corner or beginning post. **Richey Manufacturing Co., CE-12, 2801 Rochester Road, Springfield, Ill.**

EQUIPMENT MATERIALS and METHODS

(continued)

Portable Heater

A SAFE, COMPACT PORTABLE heater that pours out 320,000 BTUs of forced warm air every hour is now being produced. Under ordinary conditions, the unit will heat 7000 sq ft of floor space with an 8-ft ceiling.

Practically Impossible To Upset

The powerful new portable is a precision, thermostat controlled, oil-burning furnace on wheels for use by contractors of every size. To start it, the thermostat is set and the heater does the rest. When the desired temperature is reached, the thermostat shuts off the fuel and ignition. At the same time, an automatic fan cut-off control allows the combustion chamber to cool and then turns off the fan. This new control prolongs the life of the motor and pump, keeps the heater from blowing cool air, saves electricity and gives the user all the heat produced.

The heater was designed to keep work moving during winter months and keep profits high. It burns fuel so completely that no dangerous fumes or gases are produced; no vent is necessary. Its design makes it practically impossible to upset. **Master Vibrator Co., CE-12, 364 Stanley Ave., Dayton 1, Ohio**

Vinyl Pipe Inserts

A QUICK, EASY AND inexpensive way of repairing underground natural gas service lines has been found in Decatur, Ill. The process involves reaming out the old cast iron lines and inserting new, vinyl pipe as a liner.

Made from a Geon rigid vinyl compound, the new pipe will stay smooth inside and out because it is not affected by the corrosive influences that affect ordinary pipe. Impervious to salt water, chemicals, acid or alkaline soils and gal-

(Continued on page 140)

EQUIPMENT MATERIALS and METHODS

(continued)

vanic corrosion, the pipe will add many years of effective life to Decatur's gas distribution system, according to the manufacturer. **B. F. Goodrich Chemical Co., CE-12, 3135 Euclid Ave., Cleveland 15, Ohio**

ALL-Purpose Forest Vehicle

A REVOLUTIONARY FOREST MANAGEMENT vehicle designed to handle a wide variety of forest work has been announced. Known as the Buschmaster, this rubber-tired vehicle is equipped with hydraulically operated bulldozer blade and grading blade, a self-contained water system, back firing system, a fire plow and a winch. A draw bar enables the Buschmaster to handle scrapers, tree planters and other attachments. Among the jobs which can be accomplished by this versatile machine are fire fighting, building and maintaining roads, earthmoving, planting, site preparation, spraying and building fire lines.

Two-Piece Oscillating Chassis

Equipped with a 100-hp diesel engine, torque converter, four-wheel drive and hydraulic steering, the Buschmaster is especially designed to work in rugged forest terrain. The vehicle's two-piece oscillating chassis and four-wheel drive allows it to negotiate rugged forest terrain and to climb steep embankments and grades. It provides speeds up to 25 mph and meets all legal highway requirements. **Gar Wood Industries, Inc., CE-12, Wayne, Michigan**

Self-Propelled Earth Drills

A NEW SERIES OF earth drills equipped with track crawlers, making them self-propelled units for easier off-highway maneuverability, has been announced.

Additional features of the Model 500 include a kelly bar crowd to provide addi-

(Continued on page 142)

EQUIPMENT, MATERIALS and METHODS

(continued)

tional digging pressure on the bucket drill when in tough, hard substrata; a new hydraulically-operated dumping arm for faster, safer dumping; and built-in hydraulic jacks to stabilize and level the rig for precision drilling.

The new model is equipped with gasoline power although Diesel power is optional. Derrick length is 42 ft and total weight is 40,760 lb. A variety of attachments are available to handle virtually any earth boring job, making holes from 12 in. to 120 in. in diameter and 200 ft deep. Telescoping kelly bar permits drilling to 90 ft without drill stems. **Calweld, Inc., CE-12, 7222 E. Slauson Ave., Los Angeles 22, Calif.**

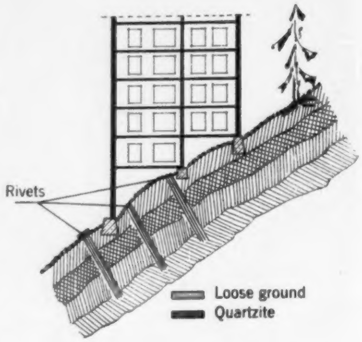
Sewer Cleaning Tool

THE MANUFACTURE AND SALE of a new improved, self-rotating sewer cleaning tool, "The Root Hog", has been announced.

Engineered and developed by an experienced sewer-dragging crew member, the tool is of heavy welded construction throughout and has specially designed cutters which will not injure pipe wall. It operates perfectly without the need of troublesome gouges or spined tools, removes roots by double action—forward for cutting—reverse for dragging out roots. Other features include a swivel draw bar of tool steel for extra strength and threaded ballast plug for weight control. Hardened cutters are available as optional extras. **The Juswel Co., CE-12, 1266 Acton Road, Columbus, Ohio**

"Rescue Team" Saves Building

ROCK DRILLING SPECIALISTS SAVED the day when a partially-completed eight-story office building began to crack up and slide away from its mountain-side perch in Altena, Germany.



Foundations for the 174 by 44-ft building had been set in a layer of loose ground that failed under the weight of five completed floors. First cracks appeared in the basement and the building began to move downhill along a layer of hard quartzite underneath it.

Engineers decided the only way to save the structure was to "fix" the loose ground to the solid subsoil, anchoring the entire building down to a firm foundation at the same time.

Deciding their regular equipment was inadequate to cope with the emergency, the contractors called in drilling experts. Armed with a heavy-duty "Bison" rock drill, the new emergency team quickly drilled about 150 two-inch diameter holes 20-ft deep through the basement floor. Then the workers set 1¾-in. dia iron bars into cement grout, effectively "riveting" the loose topsoil to the solid rock below.

The workers formed a solid block with every four of the long "rivets", providing a series of firm anchors for the structure above. To complete the job, the drilling specialists linked these "blocks" together with reinforced concrete beams. **Atlas Copco Eastern, CE-12, 610 Industrial Ave., Paramus, New Jersey**

Literature Available

ALLSPAN OPEN WEB FRAMING—Design information of Allspan open-web structural steel framing members is available in a 28-page manual MA-59. The booklet gives complete dimensions and properties of the new Allspans, which have a design stress 25% higher than conventional open-web structurals and a safety factor 12% higher. Available for spans up to 120 ft, short, intermediate and long span framing members can for the first time be chosen from a single table of allowable loads. The booklet also illustrates general construction details for all sizes of Allspans. **Macomber Incorporated, CE-12, Canton 1, Ohio.**

PORTABLE DREDGES—Some of the advantages of the portable dredges described in the 4-page illustrated brochure are: one man pushbutton control; elevated control room; powerful hydraulic drive in cutterhead and winches; 80% less moving parts and 80% less maintenance. **American Marine & Machinery Co., CE-12, P.O. Box 1150, Nashville, Tenn.**

REINFORCED ASPHALT PROCESS—Those interested in learning of the latest developments in the reinforced asphalt process may obtain a copy of the 16-page illustrated booklet entitled "Welded Wire Fabric Reinforcement of Asphaltic Concrete Overlays." A major portion of the bulletin is devoted to practical hints and recommendations for the designer and the contractor, including a detailed discussion of the devices (mostly job-rigged) which assure successful handling of the wire fabric. Typical drawings showing layout and positioning of the fabric in different applications are included. **Wire Reinforcement Institute Inc., CE-12, Dept. 238, National Press Building, Washington 4, D. C.**

CRANE & HOIST ELECTRIFICATION—Numerous illustrations in Bulletin No. 76 show the use of Feedrail Trolley Busway Electrification Systems in varied crane and hoist installations. Advantages of the prefabricated, standardized units are given. Intermittent and continuous service ratings are shown for all Feedrail Systems applicable for use with cranes and hoists. **Feedrail Corp., CE-12, 125 Barclay St., New York 7, N. Y.**

"T-1" STEEL—Available to fabricators and welders is a detailed booklet on "How to Weld U.S. Steel's 'T-1' Steel." The brochure also includes a "heat input calculator" for use in welding "T-1" steel. It is a circular slide rule which determines correct heat amounts as related to amps, volts and speed of the welding arc. The calculator is made especially for welders to use on the job. **United States Steel Corp., CE-12, Rm. 2801, 525 William Penn Place, Pittsburgh 30, Pa.**

Literature Available

LAND RECLAMATION—This 12-page booklet describes the way enterprising businessmen are turning swamps and marshes into usable and valuable acreage. Two of the land reclamation ventures discussed are Key Colony Beach in the Florida Keys and Venezia, a 1,200 home-site development near New Smyrna Beach, Florida. Key to the profit boom in land reclamation is the vast improvement in portability, versatility and economy of hydraulic dredges, which are designed to work with proved efficiency and economy and feature compact hulls, shallow drafts, low superstructures, and can be operated by a minimum of three men. **Ellicott Machine Corp., CE-12, 1611 Bush St., Baltimore 30, Md.**

TECHNICAL DATA CATALOG—A newly revised catalog for 1959-60 of Lefax $1.25 Technical Data Books has been announced. Covering every field of engineering and of constant use to engineers, technical men, surveyors, shopmen, teachers and students, the books contain about 140 loose leaf pages of up-to-date material. A partial list includes: highway engineering, surveying tables, surveying theory and practice, general math, conversion tables, architecture, and builders data. **Lefax Publishers, CE-12, 900 Sansom St., Philadelphia 7, Pa.**

YEAR AROUND CONCRETING—An 8-page pamphlet entitled "Year Around Concreting" summarizes the new American Concrete Institute's standard recommendations for cold weather concreting. It includes sections on accelerators, preparation before concreting, winter concreting objectives, and production required. A 2-page chart illustrates data on the effect of 2% calcium chloride at temperatures of 73, 55, 40, and 25 F, on Type 1 and Type 3 cement. Guide specifications are included for architects and consulting engineers. **Calcium Chloride Institute, CE-12, 909 Ring Building, Washington 6, D. C.**

SORBTEX—A comprehensive technical manual has been published to assist engineers in solving objectionable vibration and shock conditions with Sorbtex preformed fabric neoprene and rubber pad materials. It contains a complete set of reference charts and text developed by extensive laboratory tests conducted over a period of many months. The company reports that many new concepts in the use of Sorbtex, a non-linear type of isolator, are presented for the first time. For example, the need for a correction factor on pad area, sheds new light on isolators of this type in determining pad thickness for various applications under machinery. **Voss Engineering, Inc., CE-12, 5649 North Ravenswood Ave., Chicago 26, Ill.**

From the MANUFACTURERS

MAINTENANCE AND OPERATION CONFERENCE— In January, Iowa Manufacturing Co., Cedar Rapids, Iowa, will hold its annual Cedarapids Maintenance and Operation Conference, which is said to be the first initiated in the Construction Equipment Industry and the only such conference now offered by a manufacturer of aggregate producing, bituminous mixing and bituminous paving equipment . . . **NEW PLANTS:** Union Carbide Corporation's Division, Linde Co., will add another link to its chain of liquid oxygen-nitrogen producing plants being built primarily to supply missile installations with cryogenic fluids. This newest plant will be located near the missile engine production facilities at Fort Crowder Reservation, Neosho, Mo. . . . A new plant to manufacture styrene-butadiene latexes will be built at Allyn's Point, Conn., The Dow Chemical Co. announces. The company will also expand styrene-butadiene latex capacity of its Texas Division at Freeport . . . **MERGERS:** A surprise move of major importance in the steel fabricating field was announced by Pittsburgh-Des Moines Steel Co., upon the consummation of merger negotiations with Hammond Iron Works of Warren, Pa. . . . The consolidation of two of its Divisions in the plate fabricating field, Graver Tank & Mfg. Co., East Chicago, Ind. and The Lang Co., Salt Lake City, Utah, has been announced by The Union Tank Car Co., Chicago, Ill. The new Division will retain the name of Graver Tank & Mfg. Co., Division-Union Tank Car Co. and will continue under the direction of Clark Root as president . . . **NEW ACQUISITION:** American Meter Co. has acquired all of the outstanding capital stock of the Granberg Corp. of Oakland, Calif., a prime manufacturer of tank truck, bulk plant and pipeline petroleum meters and pumps . . . **DISTRIBUTOR APPOINTED:** The Construction Equipment Division of McKiernan-Terry Corp., Dover, New Jersey, has anounced the appointment of Gierke-Robinson Co., Davenport and Des Moines, Iowa, as its distributor for northwestern Illinois and central and eastern Iowa . . . **RETIREMENT:** Retirement of J. J. Jurgens, general superintendent of five factories of The Robinson Clay Product Co., Akron, Ohio, is announced . . . The retirement of Wendell G. Reycroft, Vice President and Director of the Bassick Co., Div. of Stewart-Warner Corp., has been made known . . . **RELOCATION:** Federal Sign and Signal Corp., one of the nations' oldest and largest producers of vehicle and industrial emergency lights, sirens, and horns, has moved its general offices and Chicago production operations from Chicago's South Side into a modern one-story plant at 136th St. and Western Ave. in Blue Island, Ill. . . . The relocation of Mack Trucks' operations in the field of Government vehicle development and procurement to the company's home offices at 1000 South Second St. was announced . . . **COMPANY RECEIVES ORDERS:** Solar Aircraft Co. has received recent orders totaling more than $1½ million for its Mars, Jupiter and Saturn gas turbine engines. The U.S. Navy ordered 80 Mars gas turbine pumper units and spare parts for general fleet use. The turbine-driven portable pumper units are designed for shipboard fire fighting . . . **COMPANY BREAKS GROUND:** The Cascade Pool Co. has broken ground on a million dollar plant which will become national headquarters of the company, manufacturers of Buster Crabbe Pools . . . **NAME CHANGE:** The corporate name of Norton Behr-Manning Overseas Inc. has been changed to Norton International Inc., according to an announcement by A. Donald Kelso, President . . . **APPOINTMENTS:** George B. Hutchinson has been appointed manager of production engineering on the Middletown headquarters staff of Armco Drainage & Metal Products, Inc. . . . A. S. Rairden, who for the last 11 years has been General Wire Rope Sales Manager of the Colorado Fuel & Iron Corp., has been made Works Manager of the Palmer plant. He has been succeeded as sales manager by George C. Jennings, previously CF&I New York District Sales Manager . . . The appointment of Charles O. Huntress as a district sales manager at Smith & Loveless has been announced.

PROCEEDINGS AVAILABLE

November

Journals: Hydraulics, Sanitary Engineering, Structural

2241. Cavitation Damage of Roughened Concrete Surfaces, by Donald Colgate. (HY) The paper reviews a laboratory study concerning the evaluation of the cavitation potential of various types of roughened concrete surfaces.

2242. Mountain Channel Treatment in Los Angeles County, by W. R. Ferrell. (HY) In the San Gabriel Mountains of Los Angeles County, channel treatment projects are being undertaken to lessen the financial burden of flood protection and to conserve water. This paper presents a brief history and the current status of these projects.

2243. Electronic Computers Used For Hydrologic Problems, by Francis E. Swain and Herbert S. Riesbol. (HY) The need for solving complex hydrologic problems rapidly has led Bureau of Reclamation engineers to the utilization of electronic computers for such studies.

2244. Digital Computers For Water Resources Investigations, by G. Earl Harbeck, Jr. and W. L. Isherwood, Jr. (HY) Digital computing equipment is now being used by the U. S. Geological Survey to analyze published streamflow data and to process data obtained in connection with water-loss studies.

2245. Hydraulic Downpull Forces On High Head Gates, by Donald Colgate. (HY) Model studies are described in which both the direct weighing method and the pressure area computation method were used to determine hydraulic downpull on two high head gates.

2246. New Developments in Sewage Sludge Treatment, by F. G. Nelson and W. E. Budd. (SA) Reduction in digestion volume requirements utilizing decreased detentions, pre-thickening and gaseous mixing has been a primary goal of recent developments.

2247. Twenty Years Of Sewage Sludge Burning At Barberton, Ohio, by Charles G. Pettit. (SA) Incineration as a means of disposing of raw sewage sludge cake from a domestic sewage treatment plant is examined. Following is a cost analysis and a breakdown of the various properties of the sewage and final product.

2248. Evaluation of Education and Research in Solid Wastes Engineering—Twenty-fourth Report of the Committee on Sanitary Engineering Research of the Sanitary Engineering Division. (SA) This paper presents the results of a survey investigating the extent of current solid wastes engineering, education, and research at sixty American universities and colleges.

2249. Metropolitan Section, ASCE, Seminar On Sanitary Engineering Research—Twenty-fifth Progress Report Of The Committee On Sanitary Engineering Research Of The Sanitary Engineering Division. (SA) The paper reviews a seminar at Manhattan College on June 5, 1959 concerning the problems of Sanitary Engineering Research and means of promoting both finances and competent students in the field.

2250. Refuse Volume Reduction In A Sanitary Landfill—Twenty-Sixth Progress Report Of The Committee On Sanitary Engineering Research Of the Sanitary Engineering Division. (SA) Presented are the results of an engineering investigation undertaken to ascertain the extent of refuse volume reduction that can be achieved initially and after a long period of storage in a sanitary land fill.

2251. Mean Residence Time Of A Liquid In A Trickling Filter, by Morton D. Sinkoff, Ralph Porges and James H. McDermott. (SA) This paper presents the results of initial hydraulic studies in which the mean residence time was determined for tap water applied to columns packed with spherical media under conditions of varying hydraulic loading rates, media size and depth.

2252. Waste Water Reclamation For Golf Course Irrigation, by Robert C. Merz. (SA) The general considerations for reuse of reclaimed waste water for golf course irrigation are delineated.

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(SM) Soil Mechanics and Foundations
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(WW) Waterways and Harbors

2253. A Balanced Ecological System For Space Travel, by Linvil G. Rich, William Marcus Ingram and Bernard B. Berger. (SA) The paper analyses the nature and requirements of a sustenance system in a "closed" environment.

2254. Industrial Waste Disposal Tailored To Stream Flow, by C. J. Velz. (SA) Two possibilities for more efficient utilization of water resources hold promise: either the stream flow should be regulated to make a higher level of total flow usable; or the industrial waste discharge should be regulated, tailored to the varying pattern of stream flow.

2255. The Waste Water Role In Meeting Water Requirements, by Max Bookman. (SA) The water-deficient area in the southern portion of California faces the need to supplement the existing local and imported sources of water supply; this requires that consideration be given to extending the use of existing sources by the reclamation of waste waters discharged to the ocean.

2256. Ultimate Load Theory For Concrete Frame Analysis, by A. L. L. Baker. (ST) This paper reviews an idealized conception of elastic members joined by plastic hinges; basic parameters, minimum values and theoretical assumptions for strength and deformation calculations of members and hinges; and the behavior of ultimate designs under working load.

2257. Fixed Point Method Of Moment Design, by S. E. Huey. (ST) A quick and simple method for finding moments in building frames is presented in this paper.

2258. Design of the Shippingport Reactor Plant Container, by J. J. Niland. (ST) Stipulation of external secondary shielding dictated the use of cylinders in partially buried enclosures. Heavy internal loads supported by the vessels, temperature and pressure movements, and fuel handling considerations complicated the structural design.

2259. Analysis Of Rigid Frames By Electronic Computation, by Ardis White. (ST) Presented in this paper is a description of a digital computer program written to solve two-hinged variable-I rigid frames; and computer output forms suitable for direct use in an engineering report.

2260. Discharge Formula For Straight Alluvial Channels, by H. K. Liu and S. Y. Hwang. (HY) The proposed discharge formula contains a discharge coefficient and exponents for hydraulic radius and slope. Both the coefficient and the exponents are given as functions of bed forms and bed material.

2261. Discussion Of Proceedings Paper 1867, 1897, 1974, 2005, 2037, 2065. (HY) Louis M. Laushey closure to 1867. Lawrence P. Johnson and Herbert A. Sawyer closure to 1897. Raymond Archibald on 1974. Morris Ojalvo on 2005. J. J. Polivka on 2037. Ming L. Pei on 2065.

2262. Design Of Prestressed Composite Steel Structures I, by Rudolph Szilard. (ST) Design and construction problems of statistically determinate prestressed composite structures (concrete slab and steel beams) are treated.

2263. Hydraulic Characteristics Of Hollow-Jet Waves, by D. M. Lancaster and R. B. Dexter. (HY) Field tests of a 96-inch hollow-jet valve have revealed close agreement between model and prototype piezometric measurements, valve needle thrust forces, and rates of discharge.

2264. Steel Buildings And Fire Protection In Europe, by Curt F. Kollbrunner. (ST) Recent trends in steel building construction in Europe are presented. Noted are the influence of improved and automatic welding equipment and the more general use of basic electrodes. The behavior of steel under influence of fire and the classifications of fire danger are reviewed.

2265. Effect Of Aquifer Turbulence On Well Drawdown, by Joe L. Mogg. (HY) The change from laminar flow to turbulent flow, in the case of water flowing through sand, occurs over a wide transition zone beginning with a Reynolds number of about 10. A method for estimating the exponent of the velocity term for head loss calculations involving flow into wells is presented.

2266. Sludge Disposal In Philadelphia, by Samuel S. Baxter. (SA) The paper describes the plants and problems of the sludge disposal in Philadelphia as well as the financial aspects.

2267. Control Of Air Pollution In Los Angeles County, by Robert L. Chass. (SA) Over the past ten years, an expenditure of more than 70 million dollars has prevented more than two thousand tons of air contaminents from entering the Los Angeles atmosphere each day. The devices employed are here reviewed.

2268. Salaries of Local Environmental Health Personnel in 1956 Report of the Committee on Salaries Conference of Municipal Public Health Engineers. (SA) The report is based upon a salary survey of over 3,000 positions in 371 local health departments. The report covers conclusions and recommendations on salaries found among sanitarians, sanitary engineers and other professional personnel in Environmental Health Programs in local health departments.

2269. Discussions of Proceedings Paper 1833, 1834, 1890, 1901, 1994, 1997, 2018, 2020, 2021, 2056, 2057. (HY) Ernest F. Brater, John S. McNown and Leslie Stair closure to 1833. J. Harold Zoller and Arno T. Lenz closure to 1834. Lorenz G. Straub and Alvin Anderson closure to 1890. Glen E. Stout closure to 1901. William H. Sammons on 1994. William G. Peterson on 1997. Peter Ackers on 2018. Emmett M. Laursen on 2020. P. Bruun on 2021. Robert O. Thomas on 2056. Fred W. Blaisdell and Phillip W. Manson on 2057.

2270. Cold-Formed, Light-Gage Steel Construction, by George Winter. (ST) Structural members, panels, and decks cold-formed from sheet or strip steel have gained wide acceptance in building construction. The paper reviews some of the peculiarities of the design of lightgage construction.

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